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CEYLON TOBACCO.

On July, 1915, twenty-six samples of tobacco from the first crop grown at the Government Experiment Station were despatched by the Department of Agriculture to the Imperial Institute, London, for a report upon their quality and value in the English market. The report was received in March, 1916, and is reproduced elsewhere together with the remarks of MR. SCHERFFIUS, the Tobacco Expert, and MR. KELWAY BAMBER, the Government Chemist. The conclusions to be drawn from the report may be summarised as follows:—

Eleven of the 26 samples (Nos 11 to 21) sent to the Imperial Institute were dark tobaccos unsuited to the English market. The cultivation of these is being discontinued.

The cigar types, Nos. 6 to 10, and Nos. 22 to 26 (ten samples) were unfermented. In future no cigar types will be sent for report without first being fermented.

The pipe and cigarette types, Nos. 1 to 5, were fairly well reported on but were criticised in some cases as to body, in others as to colour. MR. SCHERFFIUS has no doubt he can meet the requirements of the market in these respects when he knows precisely what they are.

Some of the leaf is described as too rich in chlorine and poor in potash. The soil and subsoil of the Jaffna Experiment Station does not contain an excess of chlorine though it is possible that the lower strata may. The soil is poor in potash as are most Ceylon soils. Arrangements have been made with the Railway for ashes emptied from the fire-boxes of engines at Kankesanturai to be sent to Jaffna for manuring the tobacco.

The well water used for irrigation has been analysed and found not to contain an excessive amount of chlorine.

The excess chlorine in the ash of some of the samples of leaf may have been due to some extent to the fact of the samples having been stored at MR. SCHERFFIUS'S bungalow which is close

to the sea-shore and in a room that was not air-tight. An air-tight fermenting and store house has now been built inland at the Experiment Station.

At the same time leaf cured at the station this year, and not stored at the sea coast, has been analysed locally and found to be still rather rich in chlorine. The cause would therefore seem to be due largely to some influence beyond our immediate control. We may be able to counteract this excess chlorine in the leaf by liberal applications of potash to the soil.

Renewed trials this year with flue curing have not proved successful. The clayey character of the soil of the station would appear to be the cause of inability to fix the bright colour.

It is proposed to submit samples of the present and succeeding crops to the local and India markets which should be able to take considerable quantities specially of cigar and cigarette types.

Seed has been distributed to various parts of the Island for trials, and instructions given; but these trials have not been satisfactory because they have been undertaken by men not sufficiently experienced. It will be necessary for us to open another station, probably at Dumbara, which is an important tobacco district.

A better report might have been obtained if the tobacco had been kept longer to ferment and age before being submitted for valuation. That would have entailed a delay of perhaps a year and in the meantime we should have been without the useful information which this report contains. This information, particularly that part of it relating to the chemical composition of the leaf, will be of considerable value in the treatment of the coming season's crop.

R. N. L.

MR. V. S. ANDRIESEN.

We record with regret the death of MR. V. S. ANDRIESEN, representative of the TIMES OF CEYLON, which took place at Kandy on July 1st last. MR. ANDRIESEN was a familiar figure at Peradeniya which he visited regularly once or twice a week for any information of public interest on matters connected with agriculture that might be available for publication. His extensive knowledge of agriculture made him peculiarly fitted for this task which he always performed with judgment and discretion. His loss will be sincerely felt by all members of the Staff at Peradeniya.

COCONUTS.

COCONUT SELECTION.

Some useful selection work on coconuts is being conducted in Fiji, it being considered that improvement in the yielding capacity of these trees is more likely to be obtained in this way than in any other. The following consists of extracts taken from a Bulletin on the subject (No. 8), issued by the Department of Agriculture, Fiji.

SELECTION.

Sixteen palms were selected in the coconut blocks on Vuna estate, Taviuni, and one nut from each tree will be planted in each plot so that all the plots will be alike, as far as the origin of the seed goes. This is regarded as an important point, as it will be possible to trace whether the results of the seed from any one palm are due to local conditions or to the characters of the plant. The whole series of plots will also show to what extent coconuts keep true to type.

In selecting the parent trees, the aim has been to get the palms of several distinct and well-marked varieties which have been observed to be good bearers. Other well defined varieties are to be met with, but as they were not known to be good bearers, or were in some cases known to be poor bearers, they have been avoided.

A knowledge of the average results of the palms, from which the selection was made, over a series of years was essential, and on this point the advice given by Mr. H. V. Tarte, of the Vuna estate, Taviuni, was invaluable, so that there can be no doubt that the selected palms are all good bearers.

The points usually recommended for the selection of coconuts have been amended in accordance with suggestions of Mr. Tarte, whose observations as to the bearing powers of varieties of coconuts are of the greatest value.

The chief points to be considered are of course the amount of kernel in each nut, and the number of nuts borne each year. Both these characters are found to be associated with certain features more readily observed by inspection, and it is upon these 'outside' features that the selection is based.

Besides any special characters, the tree must be in a healthy condition and of vigorous appearance with deep green leaflets. The leaf-stalks may be either green or have a red colour of varying degrees of intensity, the mature nuts having the same colour as the leaf-stalks. Palms with light green leaflets should always be avoided. The age of the tree is not considered very important so long as the palm is bearing well. The plants should be taken from the general cultivation rather than from some particular spot where the conditions may be considerably more favourable than the average. The plants should have a good 'head.' Sometimes leaves are to be seen occupying only the upper half of the sphere of which the 'cabbage' is the centre, and the tips of the leaves the circumference. In other cases leaves occupy practically the whole of the sphere. In the former case the effect would be caused by the leaves dropping off at a comparatively early stage, while in the latter case they persist for a long time. Since the leaves are responsible for the work of converting the material taken up by the roots and from the air into material suitable for use by the growing parts of the plant, it is reasonable to suppose that where a tree carries a better 'head' of

leaves it will give a better crop. It may be argued that such trees are more likely to damage by storm; this is, however, a risk that must be taken. Those palms having slender stems are to be preferred, as they are found to give more to the wind and so escape being broken off or blown over as may be the case with the unyielding stout tree. The tree must be satisfactory as regards health and vigour, otherwise the slenderness may be a sign of poor nutrition. The stem should be uniform and not rapidly tapering.

Some variation is seen in the length of the stalk of the bunch. It is not certain whether this is a permanent character or not, but observation has shown that plants showing this character are often good bearers.

The nuts should be narrow at the stalk end. Nuts wide at this point tend to squeeze one another out of the bunch. In order to compare one strain with another as regards this point, the method used was to measure the distance between two blocks, 1 inch high, the edges of which just touched the nut placed upright with the stalk end on a table. The husk should be thin. Whatever variety is being chosen, medium-sized nuts should be selected.

A table is here given in the Bulletin showing the characters of the varieties selected as regards (*a*) age of tree, (*b*) girth at 5 feet, (*c*) colour of mature nuts, (*d*) girth of nut, (*e*) thickness of husk, (*f*) length, (*g*) weight of dry nuts, (*h*) weight of water, (*i*) weight of kernel, (*k*) calculated weight of copra, (*l*) calculated number of nuts per ton of copra. The measurements for individual nuts of one and the same variety or strain exhibited remarkable uniformity. The calculated number of nuts to make a ton of copra showed a variation of 4,978 and 3,381 in the sixteen averaged results put forward.

COPRA FROM SAMPLE SEED-NUTS.

The kernels of the first eight varieties were exposed to the sun with the idea of preparing copra, but two rainy days set in and the copra became very mouldy. In addition to this there was some uncertainty as to whether some of the copra from two particular nuts had not been mixed together. The total weight of copra amounted to 57·1 per cent. of the kernels..... The weather for five days was fine and dry with fairly strong south-east winds; the kernels were not exposed to the sun at all. Drying proceeded very well, and during that time 37 per cent. of the kernels dried out. In five more days excellent samples of copra were obtained from all the kernels, no signs of mould being seen. Each lot of copra was carefully weighed, the percentages of copra in the kernel being from 58·8 to 61·3, the average being 59·9

CROPS.

It may be remarked that with 3,854 nuts to make 1 ton of copra or 193 to make 1 cwt., four nuts per tree per annum will give 1 cwt. of copra per acre with trees set 30 feet by 30 feet apart.

In considering this point it must be borne in mind that the figures are obtained from sixteen nuts only; they were, however, the nuts which came nearest to the average measurement of each kind; the kernels were most carefully weighed to the nearest gram (·0022 of 1 lb.). It is true that they were selected nuts to start with, but as the improvement of coconut cultivation, as in most other agricultural industries, depends largely on careful selection, the figures may be taken as indicating what should be possible.—

AGRICULTURAL NEWS.

COCONUT CAKE AS A CATTLE FOOD.

K. J. J. MACKENZIE AND E. H. POWELL.

Since the outbreak of war the shortage of linseed and coconut cakes has caused the stock-feeder to turn his attention to feeding stuffs which were somewhat unfamiliar to him. Of these, coconut, ground-nut, and palm-nut kernel cakes are by now well-known examples. Considerable information as to the use of these foods in other countries is available in text books on feeding, but it was thought advisable, before recommending their general use, to carry out as many experiments as possible, and to accumulate experience as to their effect on English live stock in the field.

Trials on the use of these cakes for various purposes were consequently instituted by the various agricultural colleges of Great Britain. The recent work at the South-Eastern Agricultural College, Wye, and at the Midland Agricultural College, has demonstrated the value of coconut cake for milk production, and results obtained by Bruce, in Scotland, with cattle feeding in winter have been published, but no information was available as to the value of coconut cake as a food suitable for beef production on aftermath or other grazing. A field-trial was, therefore, conducted on the farm belonging to the Cambridge University School of Agriculture with a view to getting evidence on this point.

The beasts used for the trial, fourteen in number, were of Hereford type; some were evidently well bred, while some showed slight but distinct signs of other blood. Animals of the Hereford type were chosen because it was believed that they would be more fastidious about cake than some of the other breeds. The animals, all steers, were from 18 to 22 months old when they were purchased at Shrewsbury on the 19th June, 1915. They cost 51*s.* per cwt. live-weight or on the average, £16. 10*s.* 0*d.* each.

CONCLUSIONS.

(1) These trials appear to show that coconut cake when suitable in price, is useful, if judiciously used, for feeding to bullocks on grass; but that it is not very palatable, and so should be gradually introduced into a mixture of more pleasing foods.

(2) The writers are inclined to advise restricting the amount to 50 per cent. of the concentrated ration. They further think it should be fed with something rather binding, such as cotton cake.

(3) It is believed that without some such food as linseed cake* which is known to be much liked by cattle, much waste would take place, as it seems that when coconut cake is fed the abundant crumb which is formed is only eaten when mixed with something very tempting, such as linseed cake dust.

(4) It is the writers' opinion that the ration to work up to is the mixture fed after 8th October, i.e. a daily ration of 4 lb. of a mixture of 3 parts of cotton cake and 2 parts of linseed cake.

The writers wish to express their indebtedness to Mr. A. J. Burgess, managing bailiff on the University farm, for the great assistance he so readily gave them in carrying out these trials, and to Miss M. A. Storry for her help in compiling the tables, etc.—Journal of the Board of Agriculture.

* Subsequently to these trials, cattle have repeatedly been found to eat freely a mixture of coconut cake and ground-nut cake.

PHILIPPINE ISLANDS COPRA INDUSTRY FOR 1915.

(Communicated.)

Exports of copra in 1915 amounted to 131,558 tons valued at over £1,500,000. These figures show a large increase both in quantity and value over 1914 when prices fell sharply immediately after the outbreak of the war and took some time to recover. There was an increase in the production of 19,103 tons and £697,310 in the value of copra compared with 1914. Destinations of principal exports of copra were as under:—

Continent (Marseilles and Barcelona)	88,021 tons.
United States	30,427 ,,
United Kingdom	11,640 ,,
Japan	1,470 ,,
	131,558

In estimating the total production of copra in the islands, the actual export figures do not offer a reliable basis, inasmuch as they do not allow for copra used for oil making, which last year was not less than 19,000 tons, or approximately 33,000 tons of the raw product, bringing up the total production to 164,558 tons.

The coconut oil industry continues to show healthy progress, the exports for the year under review being valued at upwards of £500,000. The figures show an increase in production over 1915 of 2,716 tons and £18,437 in value. This industry has been seriously handicaped by the war, and it is noteworthy that it should not merely have maintained its position, but made further progress in spite of adverse conditions.

The new oil mill now under construction in Cebu was to have been fully completed before June, 1916, and judging from its capacity it will apparently be able to absorb the entire copra supplies which at present find their way to that port, estimated at 50,000 tons, besides drawing on supplies from other adjacent coconut producing districts.

The price of copra during the first half of the year was low in comparison with the average quotations ruling during the past few years, but there was a marked recovery in the second half of the year when prices rose to unprecedented figures, so the year must be considered as a prosperous one for growers. Extremely high freights have fortunately not been felt by the growers as the increase in rates has been absorbed by a corresponding rise in the price of the article in the consuming markets.

It is not expected that the large production of last year will be reached in 1916 as drought and typhoon have caused some damage, and it is noticeable that after very heavy crops the trees appear to "rest" and do not bear in the same prolific way.

The industry notwithstanding the very poor quality of the bulk of the copra is in a highly prosperous condition. A large increase in the number of trees under cultivation is going steadily on from year to year and a corresponding development in the exports of copra may be looked for in the future, when the increased production of oil will doubtless be a marked feature of the trade, the exports being chiefly to America.

RUBBER.

METHODS OF PREPARATION OF BRAZILIAN AND PLANTATION RUBBER.

In a paper by G. Stafford Whitby read at the London Section of the Society of Chemical Industry the author sets out to compare the methods of preparation of Brazilian and Plantation Rubber. To obtain a strict comparison latex from a number of trees was obtained and bulked, a portion was smoked in the Brazilian fashion and a portion made into smoked sheet, as carried out on Rubber Estates. Comparative experiments were also made from old (15 years) and young (5 years) trees. When performing the Brazilian process, ammonia was added to the latex to prevent premature coagulation, a procedure followed in Brazil in making Fine Hard Para.

The different methods were tested by the effect of vulcanisation on the resultant rubber. Schidrowitz's methods were followed throughout, 8% of sulphur being used. The cure was carried out in a steam autoclave for 2 hours at 141°F (40 lb. steam). Variations of 15 minutes were given to obtain the "perfect" cure, deduced from the stress-strain curve in the preliminary tests. The tensile strength was made on a Schopper machine. Rate of curing, type of curve, breaking load, elongation at break were noted. The results of the examination prove that in rubber obtained from old and young trees, the Brazilian method of preparation proves inferior to the methods at present followed on estates in making smoked sheet, and the Brazilian methods retarded the cure. To further investigate this latter point latex was coagulated after the addition of phenols and cresols, the resultant rubber was slower in cure and of poorer quality than the control without the addition of phenols and cresols. The author considered that due to the small proportion of phenols absorbed from the smoke, that they are only partly responsible for slow cure and that formal-helyde from the smoke and heat also have a bearing on the question. The effect of oxidation was also studied. Oxidation according to the author is traceable to the system of tapping and the position of the cut on the trunk, but there seems to be no connection between the depth of colour and vulcanising quality. The presence of phenols has a marked accelerating effect on the rate of oxidation. The action of phenols is considered specific.

No difference was found between the dark oxidised outer layer and the inner unoxidised layer of Brazilian mass; these results negative the idea that the outer layers were inferior to the inner owing to oxidation, and the superiority of the inner layer due to the pressure caused by evaporation from the outer layers. The idea that a high water content in the Brazilian ball is favourable to the rubber is also negatived by these results.

Creping has no effect on prepared rubber, but depreciates the prepared rubber when creped in wet coagulum.

Rubber from trees varying from 4-17 years was tested after vulcanisation and results were found to be fairly constant, thus the contention that prepared rubber from young trees lacked strength is not justified.

In comparing the methods of preparation of plantation rubber, creped rubber was found inferior to sheet rubber. Smoking creped rubber depreciated it considerably. Little difference was found between smoked and unsmoked sheet. Prolongation of smoking on sheet rubber did not improve the quality.

In experimenting it was found that variable results were produced for rubber from the same area (100-200 trees), at different times, working under identical conditions. These differences disappeared on the area being increased to several thousand trees. Arguing well for the bulking of the day's latex before preparing the rubber for the market, acquiring uniformity of product for the estate.

Allowing latex to stand before coagulation had little effect but strength was gained if the latex remained undiluted for several hours before coagulation, strength was slightly lost by coagulating at once or diluting the latex for some hours before coagulating.

In the discussion that followed the reading of the paper, the following gentlemen took part which shows the interest the paper roused :—

PROFESSOR ARMSTRONG
DOCTOR STEVENS &
MR. RUSSEL PELLY

PROFESSOR ARMSTRONG stated in discussion that considering that 100 millions sterling was sunk in the plantation rubber industry little was being done in research work, the present investigators although hard at work could not undertake without further assistance the great questions awaiting to be solved in the rubber industry. DR. STEVENS and MR. PELLY explained what was being done in the way of research work in Ceylon and Malaya and considered that planters and others interested were looking after the product from a scientific point but more workers on the subject would be welcomed to place the industry on a safe basis.

DR. STEVENS argued that the exact method of preparation of Brazilian rubber was not known so that comparison of the prepared products from the East were of comparatively little use. One of the points mentioned was the greater retention of moisture in the Brazilian ball compared with the ball prepared in the East. It was suggested that adherence to a theoretical mixing such as 8-10% of sulphur was not a broad enough basis on which to compare prepared rubbers; experiments should be tried on various complex mixtures such as manufacturers use, at the same time trying to find the relation in the vulcanised rubber between such a mixing as 8-10% sulphur with complex mixings. No ageing tests were made which are of great importance. DR. STEVENS further stated that when comparing the author's result with his own and others, that many results with vulcanised rubber had been confirmed but that he hardly agreed with the author's statements about smoked sheet. DR. STEVENS considered EATON and GRANTHAM'S "optimum" cure to be decidedly over cured.

A. BRUCE.

According to the JOURNAL OF THE BOARD OF AGRICULTURE, England, there were in October, 1915, 3,129 school gardens in England in which 56,037 children of elementary school age were receiving instruction in practical gardening.

TEA.

THE TEA INDUSTRY IN INDIA.

Conditions brought about by the war continue to produce some remarkable economic inconsistencies. The report of the Doom Dooma Tea Company issued yesterday, (June 2) for instance, draws attention to the rather extraordinary condition of the tea trade. Exceptionally favourable weather enabled the Indian tea gardens last year to increase their output by something like 50 million pounds, and yet the price of tea is higher than it has been for years past. Under normal conditions such an enormous increase in production would have caused the price to fall, but the losses at sea, scarcity of tonnage, and producers' arrangements for regulating the supply have deprived the consumer of this advantage. In spite of the higher prices ruling, consumption has not apparently fallen off, for the demand for tea has been and continues to be insistent. It is believed that stocks in consumers' houses and in retailers' shops have for some time been larger than usual, owing partly to fears of additional taxation. These circumstances have given the speculator his opportunity and he has not been slow to take advantage of it.

LOWER COST OF PRODUCTION.

Owing to the much larger crops obtained, the cost to the planter of producing a pound of tea has sensibly diminished meanwhile. The Doom Dooma estimated its outturn to be 3,920,000 lb., the actual crop was 5,049,590 lb., against 3,885,371 lb. in 1914. The total cost of production was 7·92*d.* per lb., as compared with 9·36*d.* in 1914, and 9·24*d.* in 1913. This reduction was effected in spite of special expenditure on war risk insurance, and higher freights. The average gross price realized was 11$\frac{5}{8}$*d.* per lb., against 11$\frac{1}{4}$*d.* per lb. in 1914, 10 13-32*d.* in 1913, 9$\frac{1}{2}$*d.* in 1912, and 10 1-16*d.* in the preceding year. Of the total increase of 1,164,219 lb. in the crop, about 270,000 lb. may be taken as natural increase from the matured area. Productivity of the gardens has been steadily increasing for many years, due to improved cultivation methods, and the average in 1914 was 611 lb. per acre. But the Doom Dooma yield last year was no less than 920 lb., against 719 lb. in 1914 and 633 lb. in 1913. The profits amounted to the record total of £80,497, an increase of £50,493. Of this total £25,000 is reserved to meet excess profits duty; £14,000 is appropriated for extension and building accounts, and the distribution is raised from 11 per cent. to 17$\frac{1}{2}$ per cent., the highest rate paid in the long history of the Company.—London Times.

TEA UNDER IRRIGATION.

The following communication from the Inspector General of Irrigation in India regarding tea under irrigation has been received by the Department of Agriculture:—

Government of India, Public Works Department,
Camp Naini Tal, the 19th June 1916.

Dear Sir,

* * * * *

I enclose herewith a statement of area actually irrigated in the Dun for the last few years and I am informed that certain gardens which have good subsoil drainage are now taking water much more freely than they did when I was in charge of the Canals in 1890, but that the gardens which have not good subsoil drainage do not take it although experiment of irrigating them has been tried on several occasions.

Believe me, Yours truly,
M. NETHERSOLE.

STATEMENT SHOWING AREAS OF TEA IRRIGATION IN DEHRA DUN, UNITED PROVINCES.

Year.	Area irrigated in acres.	Year.	Area irrigated in acres.
1901-02	1,231	1908-09	1,313
1902-03	474	1909-10	1,487
1903-04	906	1910-11	1,550
1904-05	968	1911-12	733
1905-06	269	1912-13	1,297
1906-07	1,035	1913-14	991
1907-08	721	1914-15	1,530

COMPOSITION OF RAIN WATER.

J. SCHROEDER.

The analyses of the rain water at Montevideo (Agronomic Institute Sayago) during the period 1909-1912 support the following conclusions:—

(1) An annual rainfall of 1504 mm. (1912) contributed to the experimental field at Sayago 6·8645 lb. of combined nitrogen per acre, of which 3·2753 was in the form of ammonia and 3·5873 lb. in the form of nitroso-nitric compounds; during a period of two years the quantity of ammoniacal nitrogen brought down was 6·052 lb. and the nitroso-nitric nitrogen 6·078 lb., making a total of 12·130 lb. or an average of 6·065 lb. per acre per annum. These figures do not exceed by much those of temperate and sub-tropical zones.

(2) The amount of sodium chloride carried by the rainfall is 73·4 lb. per acre per annum; the percentage of chlorine in rain appears to depend on the direction of the winds during the rainfall.

(3) The quantity of organic matter in rain water determined in terms of the amount of oxygen required to oxidise it averages 750 mg. of oxygen per 1,000 litres.

(4) The total residue on evaporation averages 303 lb. per acre per annum, of which 108 lb. disappeared on calcination, leaving 195 lb. of non-volatile matter.

These figures relate to the above-mentioned locality and the writer hopes that similar studies will be extended to all parts of South America.—BULLETIN INT. INST. OF AGRIC.

RICE.

CORRELATIVE CHARACTERS OF THE RICE PLANT.

H. O. JACOBSON.

The period of time required to mature a crop of rice, if not less than 120 days nor more than 180 days, does not have any appreciable effect on yield of grain if growth takes place under normal conditions.

Extra early maturity is to be had at the expense of yield.

This statement is based on our experience with a considerable number of both lowland and upland varieties of rice which matured in less than 120 days though not less than 100 days. None of these, however, have produced heavy yields of grain or even satisfactory returns in comparison with varieties requiring a growth period of from 30 to 45 days more.

Very late maturity affords too many opportunities for unfavourable weather conditions, diseases and pests to injure the plants and thus lower yield of grain.

A variety that tillers freely will produce more grain per hectare than one that does not, but when rice is transplanted the actual operation of tillering can be very largely regulated by the number of plants set in the hill. The true significance and value of the tillering character is not yet fully apprehended but may be regarded as very desirable. An unusually pronounced tillering habit is not particularly desired in ordinary lowland culture.

It is essential to clearly understand that tillering, the number of grains per panicle and grain or seed size are elastic or compensating characters and that each in turn is affected by the one preceding it and the development of the character is extended or curtailed, as the case may be, by the prevalent environmental conditions and is based upon the extent of the development of the preceding character.

In this connection, the most striking difference between oats and barley and rice should be noted. Oat and barley attain maturity in a very short period of time, passing from the tillering stage to the kernel-forming stage in rapid succession. An ordinary six-month variety of rice, on the other hand, develops slowly, passing through each period of development gradually, consequently it is possible that the plants may enjoy optimum conditions at the tillering stage, the minimum of more probably maximum conditions during a part of the next period, with a possible return to optimum in the succeeding stage, or, the successive stages may be affected variously by a number of combinations in environmental conditions; rarely would optimum conditions prevail throughout. Nevertheless, the degree of tillering, number of grains, size of grains and density of grains are dependent to some extent on the degree of development in each stage and on environmental conditions.

Thus, if tillering has been checked or is not sufficient for the plant's requirements when the seed number is being determined, there will be a close approach to the maximum number of seeds, and if the food supply or

water supply is checked, or other unfavourable influence operate later, the seed size is diminished.

Therefore, in passing judgment on a variety, the number of culms per unit of area, the average number of grains per panicle, and the net kernel weight and volumetric measurement must be accurately determined.

The height of the plants, straw or culm, or, as it has been termed before, culm length, has noteworthy influence on yield, but there appears to be no connection between the culm number per plant and average culm length. The highest yields have been obtained by varieties with a culm length of about 1·5 metres and a little over. If a culm length is less than 1·5 metres the yield per hectare diminishes as the average straw length becomes shorter.

The reader should bear in mind that these figures apply only to lowland varieties grown in the low altitudes in the Philippine Islands.

The number of grains per panicle has little influence on yield. The variety with but one hundred grains per panicle may yield as much grain per hectare as one with three hundred.

The number of grains for a variety is dependent on the tillering habit, the great dimensions and density. As a general rule the varieties which have a large number of grains per panicle have small grains while varieties with few grains per panicle have large grains. Again, the many-seeded varieties do not as a rule steel as freely as the one having less seeds or grains per panicle.

Grain length considered apart from width has no correlation with the tillering habit, neither does it appear that the slender grains are found on varieties which tiller little, as has been supposed.

The shape of the grain has no effect on yield, nor does there appear to be any correlation of grain shape, in so far as the two dimensions, length and width are concerned, to the degree of tillering. There appears to be no difference in the amount produced by varieties having short plump grains when compared with those having long slender ones.

The number of grains borne on the panicle is an elastic or compensating character, and for that reason is more widely distributed, but the figures show a rather positive correlation of the number of grains per panicle to the days to maturity. If a variety has an unusually large number of grains per panicle it is quite probable also that it is late maturing.

Varieties that tiller poorly are frequently late maturing, but this habit cannot by itself be given very much weight in attempting to estimate the probable growth period required by any given variety.

Grain length, irrespective of its proportion to width, has a positive correlation to the maturing period, so that to a given extent, the longer the grain the more time the variety requires to reproduce itself. Width of grain acts in the opposite direction and as the grain becomes wider the time period is shortened. When the dimension characters of the grain are considered separately, they appear to affect each other, but when these dimensions are treated on the basis of the ratio of one to the other, we find that the slender kernel is but seldom found among the early-maturing varieties and as this shape becomes pronounced, it is found only among medium-early and late-maturing kinds. Thus, if a variety has a grain twice as long as it is wide, there is little likelihood of its being anything but an early maturing sort; if the grain is three times as long as it is wide, the range is very wide but it is more probable that it is medium early to late in maturing; and, if the ratio is four to one, there is hardly any chance that the variety is early.

A similar situation prevails in the maize plant. Varieties having very deep or long grains require a longer period to attain maturity than do varieties with short or shallow grains.

Since the amount of time required to attain maturity, if within the limits indicated above, does not have any marked influence on the yield of grain, the principal interest in this character is with regard to selecting a variety which most suitably fits average rainfall conditions in the district in which it is to be cultivated.

Varieties with culm length of 1 meter to 1·5 meters are widely distributed as to the time period required to maturity, but when the culm length exceeds 1·5 meters the maturing period is more commonly found to be relatively long. For 167 varieties having a culm length of 1·5 meters, the mean growth period was 164·6 days, while 84 varieties with a culm length of 1·7 meters required 172·4 days. One hundred varieties with a mean culm length of 1·20 meters required 157·7 days to maturity. In our region, therefore, varieties with short culms are usually earlier maturing than varieties with long culms. Culm length is positively correlated to the time period required to maturity.

The length of the rachis corresponds to the length of the culm. If the culm is short the rachis will probably be short also.

Long culms have more nodes than short ones. The number of nodes is a more dependable indicator of the normal straw length than one or two season's measurements of the culm itself. The length of the culm varies considerably from season to season according to the growth conditions prevailing, but the number of nodes is quite constant, in a given variety.

The number of nodes bears approximately a similar relation to the growth period of a variety as does culm length, hence varieties which have many nodes tend to be later maturing than those with a smaller number.

The length of internodes of a given variety varies considerably from season to season, but the mean internodal lengths of varieties with a given number of nodes tend to fall within narrow limits and the mean internodal lengths vary but slightly with respect to the number of nodes.

Varieties with few nodes have slightly longer internodes than those with numerous nodes.

The number of nodes have no other bearing on yield than its association and correlation of node number to culm length implies.

More branches are found on a panicle with a long rachis than one with a short one, and the relation between length of rachis and number of branches is positive and quite regularly progressive when a large population is considered.

The length of the rachis in comparison with the number of branches is a relative index to the density of the panicle.

The length of the grain has a slight positive correlation with the culm length, though there are numerous exceptions, and associations run irregularly. If there are other characters present indicating long culm length, long grains may be regarded as additional corroborative evidence.

Investigators are busily engaged in the attempt to learn what is the proper thing to do and incidentally they learn what not to do. Those negative facts are as important as the others, since by having a knowledge of the characters to avoid, the plant breeder can eliminate at the beginning all the material that is likely to prove unsatisfactory and concentrate on that which is promising.

In viewing the foregoing it appears that moderation is a good rule to observe, and, if moderate excellence is attained in all essential characters, very material progress has been made, for nearly all varieties possess the several characters in widely differing degrees.

The real aim of the plant breeder is to approximate excellence in all essential features.

The superlative may be the aim but experience shows that this degree is usually attained only at the cost of some highly desired character.

Of course, any standard is for the time being, only an arbitrary means of measuring results, and as soon as this is attained the standard is again advanced.

Most of the characters of the rice plant vary considerably and to some extent independently of the other characters, but a review of the foregoing leads to the conclusion that when the combination of these several characters is effected, each in a moderate degree, the highest consistent yield of grain will result. It appears that neither the short nor the very long culm is as closely associated with high yield as is culm of a medium length; not the extra early or the very late, but the medium; not the scant tillering varieties nor the very profuse, but the more moderate; and so forth. The same appears to hold good with the relationship of other characters indirectly associated.

When the modern varieties of cereals are considered it will be noted that the most productive of these do not run to extremes in any character. The most productive barley and oat varieties, for instance, which have more recently been given to the public, are remarkable for their balance or symmetry of characters.

The conclusions of prominent maize breeders appear to indicate that a moderate development of the major characters is most desirable and it is quite noticeable that the word "medium" or some synonym occurs very frequently in their writings on the subject.

Finally, knowing what is to be avoided, there still remains the problem of selecting the most productive individual from among the many which manifest the sought-for indications of merit, but that is more a matter of accurate judgment and carefully kept records. As DR. H. HJALMAR NILSSON says :—"The only unity with which we should work must be the living plant itself and not at all—as had hitherto been supposed—its individual organs ; the ear, the grain, etc., to which different hereditary dispositions had been attributed.—PHILIPPINE AGRICULTURAL REVIEW.

MR. MAXWELL LEFROY, Curator of the Insect House at the Zoo, claims to have found the ideal bait for the house fly, viz, casein, brown sugar and water mixed in equal parts. The mixture must be left for 24 hours before use. Placed in a wide mouthed bottle, the smell seems to attract the insects. Casein can be made by coagulating milk, when it breaks up into a solid and a liquid, the former being the casein.

TOBACCO.

REPORT ON TOBACCO FROM CEYLON.

The samples of tobacco from Ceylon which are the subject of this report were forwarded to the Imperial Institute by the Director of Agriculture with letter No. 2,553 dated 10th July, 1915. The samples were delayed in transit and did not reach the Imperial Institute until October, 1915.

DESCRIPTION OF SAMPLES.

No. 1. "White Burley Flyings." Weight 2¾ oz. This sample consisted of light brown, thin leaves from 18 to 19 inches long and from 8 to 12 inches wide.

No. 2. "White Burley Trash." Weight 2¾ oz. These leaves were about 19 inches long and from 9 to 11 inches wide. They were of a light brown colour, and rather badly torn.

No. 3. "White Burley Lugs." Weight 4 oz. These leaves were fairly uniform in size, being about 22 inches long and 10½ wide. They were of a light brown colour and were somewhat spotted and slightly torn.

No. 4. "White Burley Bright Leaf." Weight 3½ oz. These leaves were medium in colour and were of fairly uniform size, 24 inches long by 12 inches wide. A few of the leaves were badly spotted and torn.

No. 5. "White Burley Red Leaf." Weight 3 oz. These leaves were of a dull brown colour but darker on the upper surfaces. They were about 21 inches long by 10½ inches wide.

No. 6. "Sumatra wrapper leaf. American seed." Weight 5½ oz. These leaves were of uniform size, about 20 inches long and 12 inches wide, and varied in colour from greenish-brown to dull brown. The leaves showed a few spots and were a good deal torn. Some of the leaves were fairly thin, but otherwise thicker than is desirable in good wrapper leaf.

No. 7. "Connecticut Seed Leaf Wrapper." Weight 3½ oz. The length of these leaves varied from 20 to 23 inches, and their width from 9 to 10 inches. They varied in colour, but were mostly dark brown and slightly greenish in places. Most of the leaves were discoloured and many slightly torn. The veins were prominent.

No. 8. "Connecticut Havana Wrapper. American seed." Weight 3½ oz. These leaves were about 20 inches long and 9 to 12 inches wide; they varied in colour, but were chiefly dark brown. The midribs were large and coarse.

No. 9. "Dumbara Wrapper Leaf. Native seed." Weight 9½ oz. The leaves were fairly uniform in size, being 20 to 23 inches long and 9 to 11 inches wide. Their colour varied from dull to reddish-brown with some patches. On the whole the leaves were coarse and rough.

No. 10. "Samsoun." Weight 2 oz. The leaves measured from 8 to 10 inches in length, and from 4 to 5½ inches in width. They were of irregular colour, varying from light yellowish brown with green patches to orange brown. The leaves were a good deal spotted and torn.

No. 11. "Dark Export, Genmine Pryor." Weight 7 oz. These leaves were about 28 inches long by 15 inches wide and were of a mottled dark brown colour.

No. 12. "Dark Export, Blue Pryor." Weight 5 oz. The leaves were uniform in size, being 24 inches long and from 12 to 14 inches wide. They varied in colour but were mostly dark reddish brown.

No. 13. "Dark Export, Tinnevelle." Weight 5 oz. These leaves were uniformly about 25 inches long by 13 inches wide and were dark greenish brown in colour.

No. 14. "Dark Export, Improved Yellow Mammoth." Weight 4½ oz. The leaves varied in colour but were mostly dark brown; they were about 22 inches long and from 12 to 14 inches wide.

No. 15. "Clardy, Dark Export." Weight 4 oz. The leaves were about 24 inches long and 15 inches wide, and were mostly dark greenish brown in colour.

No. 16. "Dark Export, Hester." Weight 4½ oz. The leaves were about 22 inches long by 12 to 14 inches wide, mostly with a dull dark brown colour.

No. 17. "Dark Export, Yellow Pryor." Weight 3¾ oz. These leaves varied in colour from dull to dark reddish brown, and were 22 inches long by 11 to 14 inches wide.

No. 18. "Dark Export, 'McAddo.'" Weight 3 oz. These leaves were uniformly dark brown in colour, and measured 23 inches long by 12 inches wide.

No. 19. "Dark Export, 'Madole.'" Weight 3 oz. The leaves varied in colour, but were mostly dark brown, and measured about 22 inches long by 10 to 11½ inches wide.

No. 20. "Dark Export, Jaffna." Weight 2 oz. These leaves varied in colour from reddish brown to dark brown, and were about 21 inches long by 9½ to 11 inches wide.

No. 21. "Dark Export, partially flue-cured." Weight 3½ oz. The leaves were about 19 inches long by 11 inches wide, and varied in colour from brownish yellow to dark brownish orange.

No. 22. "Zimmers Spanish cigar filler, American seed." Weight 11 oz. The colour of these leaves varied from greenish or yellowish brown to reddish brown. They were uniformly about 18 inches long by 7 inches to 10 inches wide.

No. 23. "Texas Cuban cigar filler, American seed." Weight 7½ oz. These leaves varied in colour from medium brown to reddish brown, and were about 17 inches long and from 10 to 12 inches wide.

No. 24. "Indian cigar filler, Indian seed." Weight 1 lb. The leaves varied in colour from orange brown to dark reddish brown, and were about 21 inches long by 7 to 11 inches wide.

No. 25. "Dumbara cigar filler. Native seed." Weight 1 lb. These leaves were from 15 to 17 inches long by about 8 inches wide, and were of irregular colour, varying from dull to dark brown, some having a reddish tint.

No. 26. "Jaffna cigar filler. Native seed." Weight 13 oz. These leaves varied in colour from a pale brown to medium brown, and were about 17 inches long by 7 to 10 inches wide.

RESULTS OF EXAMINATION.

Of the twenty-six samples submitted, nine were selected for chemical examination and the results of this work are summarised in the table appearing on next page.

	Burley.	Sumatra.	Pryor.	Tinnevelle.	Zimmers Spanish.	Texas Cuban.	Indian.	Dumbara.	Jaffna.
	Sample No. 3 %	Sample No. 6 %	Sample No. 11 %	Sample No. 13 %	Sample No. 22 %	Sample No. 23 %	Sample No. 24 %	Sample No. 25 %	Sample No. 26 %
Moisture*	14·0	14·0	14·0	14·0	14·0	14·0	14·0	14·0	14·0
Nicotine	2·1	2·7	3·8	4·0	2·9	2·2	2·5	1·7	1·8
Nitrogen	1·9	2·5	3·1	3·2	2·6	2·2	2·2	2·7	1·9
Ash	24·6	18·3	17·3	15·5	18·9	19·4	21·2	17·2	21·7
The ash contained:—									
Lime, Ca0	33·4	33·6	28·8	27·1	34·8	30·6	27·7	34·3	30·2
Magnesia, Mg0 ...	5·5	8·1	6·1	5·1	6·4	6·4	3·3	7·6	6·6
Potash, K_20	16·3	16·1	22·7	18·5	16·0	9·3	11·9	10·6	6·7
Soda, Na_20	2·8	2·8	2·9	3·2	2·7	2·1	3·3	5·0	1·9
Sulphates, expressed as sulphuric acid $S0_3$ ...	2·7	3·0	3·2	3·1	2·8	1·7	2·1	3·9	2·1
Chlorides, expressed as chlorine C1 ...	15·0	13·4	9·5	9·2	14·7	12·1	9·2	10·4	7·6
Carbonates, expressed as carbonate dioxide, $C0_2$ ...	11·3	10·7	18·1	12·6	12·8	6·6	8·1	11·3	8·6

*All the samples were "conditioned" at the Imperial Institute before examination, and the quantities of moisture recorded are those found in the "conditioned" tobaccos.

COMMERCIAL VALUATION.

The samples submitted were in many cases so small that the examination of the tobaccos was delayed by the fact that the samples had to be submitted in turn to manufacturers and the chemical examination could only be proceeded with after the valuation had been obtained, and when that had been done there was not enough left for satisfactory cutting and burning tests. In forwarding samples of tobacco for examination and valuation at least four complete hands of each variety should be sent, as this enables the work to be greatly expedited and also makes it possible to get opinions from more manufacturers.

The twenty-six samples of tobacco were submitted to two firms of manufacturers for valuation. The first firm reported that none of the samples are really suitable for the English market. They added that if the types marked as cigar wrappers and fillers could be used at all in this country they could only be employed as common cutting tobaccos. They stated that the flavour of all the tobaccos when smoked is pungent and unpleasant. The firm quoted the following opinions and valuations regarding the samples, pointing out, however, that it might prove impossible to sell the tobaccos even at these rates.

No. 1.	Too thin-bodied	Value	3*d.*	per lb.
No. 2.	Deficient in quality when smoked ...	,,	3*d.*	,,
No. 3.	Fair colour; not much body ...	,,	4*d.*	,,
No 4.	Fair tobacco in colour and length ...	,,	4*d.*	,,
No. 5.	Fairly useful in colour and length ...	,,	4½*d.*	,,
No. 6.	Poor	,,	2½*d.*	,,
No. 7.	Very rough and coarse	,,	2½*d.*	,,
No. 8.	Rather rough	,,	3*d.*	,,
No. 9.	Unsuitable for cigars	,,	4*d.*	,,
No. 10.	No aroma resembling that of Samsoun tobacco; too short for other use ...	,,	nil	
No. 11.	Long, but very rough and coarse ...	,,	3*d.*	,,
No. 12.	Very rough and coarse	,,	2½*d.*	,,
No. 13.	Very rough and coarse	,,	3*d.*	,,
No. 14.	Clean, but rough and coarse ...	,,	3*d.*	,,
No. 15.	Heavy bodied, rough and coarse ...	,,	3*d.*	,,
No. 16.	Poor flavour, rough and coarse ...	,,	2½*d.*	,,
No. 17.	Rough and coarse	,,	2½*d.*	,,
No. 18.	Rough and coarse	,,	3*d.*	,,
No. 19.	Very coarse	,,	2¾*d.*	,,
No. 20.	Narrow rough leaf	,,	2¾*d.*	,,
No. 21.	Poor and brittle	,,	1½*d.*	,,
No. 22.	Green, unripe and poor	,,	2 *d.*	,,
No. 23.	Short and rough	,,	2½*d.*	,,
No. 24	Very narrow sandy leaf	,,	2½*d.*	,,
No. 25.	Unsuitable for cigars	,,	2*d.*	,,
No. 26.	Unsuitable for cigars	,,	2*d.*	,,

The second firm stated that the tobacco represented by these samples are not suitable for the British market, but suggested that they might find a market in small quantities for mixing at 4*d.* to 6*d.* per lb. They added that the White Burleys, samples Nos. 1 to 5, might, with careful cultivation, be made suitable for the British market.

REMARKS AND GENERAL CONCLUSIONS.

The results of the analysis of the nine samples of tobacco which were examined in detail show great variation in the composition of the tobacco, although the samples were all grown in the same locality and were apparently all subjected to the same treatment, viz., air-curing. The amount of nicotine is not excessive, although in Nos. 11 and 13 it is rather high, especially when the high nitrogen in these two samples is also taken into account. These, however, are both described as "dark export chewing tobaccos" and in these types high nitrogen and nicotine are less objectionable features than in smoking tobaccos.

The amount of ash present in the tobaccos shows considerable variation, but the most noteworthy point, as regards the composition of the ash, is the variation in the amount of potash, which ranges from 6·7 in sample No. 26 to 22·7 in sample No. 11. The burning quality of tobacco is largely determined by the amount of potash and in selecting varieties for further trial in Ceylon some attention should be given to this point. The quantities of sulphates and chlorides in tobacco are also important, as these adversely affect the burning quality. The chlorides are present in excessive amount in all these tobaccos, indicating that the soil at the Jaffna Trial Ground is too rich in chlorides to be an ideal situation for tobacco cultivation. Attention has been directed to this point in previous reports on Ceylon Tobacco (see The Tobacco Industry of Ceylon, Bulletin of the Imperial Institute, Vol. X. (1912), pp. 187-205). Most of the Ceylon Tobaccos examined at the Imperial Institute have proved to contain excessive quantities of chlorides, and this is a serious difficulty in the way of producing smoking tobacco of first class quality, particularly cigar tobacco.

There is, however, one interesting exception to this viz., the sample grown at Talwatte from Dumbara seed and dealt with in the Imperial Institute report of the 18th June, 1915.

A number of these tobaccos were cut for the Imperial Institute by a manufacturer and their burning quality tested in the form of cigarettes. When fine cut they burned fairly well, but in no case would the burning be described as good. Still it was not bad enough to prevent the use of these tobaccos on that ground alone, since for cutting purposes it would be possible to blend them with tobaccos such as those of Nyasaland, which show particularly good burning quality. In the case of the cigar tobaccos, however, poor burning quality is a more serious defect.

It would be unsafe from the data at present available to draw final conclusions from the analyses of these tobaccos, but the following suggestions may be tentatively put forward for consideration in arranging future trials :—

(1) Judging from the general tendency to coarseness shown by all these tobaccos and the rather high nitrogen and nicotine figures shown by some of them, the soil in this trial ground is too rich in organic matter for tobacco cultivation; this condition has probably been produced by heavy manuring with organic manures. The soil is probably rather poor in the mineral constituents necessary for plants, especially potash, though it seems to be fairly rich in lime and magnesia.

(2) The use of manures containing chlorides and sulphates should be avoided.

(3) In any further manuring of the ground artificial manures rich in potash should be applied.

In considering these suggestions it must be borne in mind that no information was supplied with the samples as to the composition of the soil, the manurial treatment, if any, adopted, or as to the previous cultural history of the trial ground. All these factors are of great importance, and the foregoing suggestions may need correction in the light of local knowledge on these points.

It will be observed that the opinions expressed by the two firms of manufacturers to whom these samples were submitted were not favourable to the tobaccos. As stated on page 82 of this report the samples were small and consequently it was not possible within a reasonable time to get a wider expression of opinion from manufacturers, but the two firms selected make a great variety of manufactured tobaccos and have both shown commendable enterprise in utilising British grown tobacco from new sources in recent years; so that it may safely be assumed that they do not take unduly conservative views of the requirements of the British market.

It must, however, be borne in mind that tobacco manufacturers in the United Kingdom have for the most part established well-known brands of manufactured tobacco the characteristics of which they must maintain. To enter the British tobacco market it is therefore necessary that new producers should endeavour to imitate as far as possible the raw tobaccos which come on this market. The principal demand in this country for the manufacture of "Virginian" cigarette and pipe tobaccos is for bright and semi-bright tobacco, and none of the tobaccos now reported on belongs to either of these categories. There is undoubtedly a large market for so-called nondescript and dark tobaccos for cutting into "shag" and other cheap mixtures, but this can always be met by tobacco waste and the inferior produce, of which a certain amount must always be available in every tobacco-growing country.

The limited capacity of the fire-curing barn to which the Director of Agriculture refers in his letter of the 10th July, 1915, and the necessity therefore of air-curing most of the samples, no doubt, account to some extent for the absence of bright and semi-bright types from the present series of samples, and this defect may be remedied in the next season. The possibility should, however, not be lost sight of that the prevalence of dark coarse tobaccos in this series of samples may be due to unsuitability of soil, and this point should be settled as soon as possible by (1) a careful investigation of the improvement possible by means of flue-curing at Jaffna next season, and (2) trials in other parts of the Island.

Special mention may, perhaps, be made of sample No. 10 which is stated to be grown from Turkish seed. It is almost entirely devoid of the characteristic aroma of Turkish tobacco. Its defects may be due to the use of deteriorated seed.

A specimen of Turkish leaf tobacco is forwarded with this report as it may be of interest for comparison with the Ceylon product. It will be noted that the genuine Turkish leaf is highly aromatic and quite different in character from that produced in Ceylon from the Turkish seed.

In conclusion it may be pointed out that there may be a better market in certain Continental countries for the dark tobaccos included in this series of samples, than there is in England, but at present the most promising markets are not available. It is understood, however, that the original object of the Ceylon experiments was to produce tobacco for the British market, and these samples have been considered mainly from that point of view. In

sending samples of the next season's crop care should be taken to send larger quantities, so that the opinion of a larger number of British manufacturers may be taken, and if necessary manufacturers in other European countries consulted. It is also advisable that samples of tobacco from the other trials now in progress in Ceylon by private growers should be forwarded for examination as in this way much useful information may be obtained. Further, if analyses of the soils on which these trials are in progress have been made, the Imperial Institute will be glad to have copies of them, so that the composition of the soils may be taken into consideration. If such analyses have not been made, samples of the soils should be forwarded with the tobacco, for analysis at the Imperial Institute.

23rd February, 1916.

Remarks by the Tobacco Planter and Curer.

Though the report on samples of tobacco sent to London was unfavourable on the whole, it is not discouraging. I feel quite sure we can produce leaf that will fully meet the requirements of the English market, when we understand exactly what is desired.

Regarding the high chlorine content of the samples, it is not unlikely that the samples took up much of that element from the sea air to which they were exposed for want of a properly constructed store room. I notice that the types running highest in chlorine are the samples that were exposed longest to the influence of the sea air. It will, therefore, be interesting to have samples of the same types from the present crop examined by the local chemist, Mr. Bamber, as soon as the leaf is thoroughly cured.

As for the cigar types, they were evidently subjected to chemical examination in an unfermented state just as they were received. The results would, of course, have been quite different if the tobacco had been fermented beforehand. The same is true in regard to properly aged Turkish leaf. The chemical changes are more mild, but the ageing is necessary to develop the aroma. Considering, therefore, the raw state of the samples we sent after the elimination of types which were not expected to suit the English market, but which would more nearly conform to types of other European countries, I consider the report encouraging and instructive. It will help us to get on in the production of types desired by the present English markets.

B. F. Scherffius.

Remarks by the Government Chemist.

The variation in the amount of potash in the ash of the tobaccos analysed must have been largely due to the varieties and their power of selection as the soil does not vary in potash content to any great extent.

The excessive chlorides are probably obtained from the coral subsoil, being brought to the surface soil during the long periods of drought succeeding the fairly heavy N. E. monsoon in October–December; also to the well water used for irrigation, samples of which should be analysed.

In the Mahailuppalama experiments the tobacco grown on higher unirrigable land burned more freely than that grown on the flat and irrigable land and it was shown to be due to a greater proportion of chlorides in the latter partly derived from the irrigation water.

For the European market the best tobaccos would probably be grown in the drier parts of Ceylon where the influence of monsoons, bringing about 40 lb. of salt per acre per annum to the coast districts, would be less felt.

M. Kelway Bamber.

FRUIT.

NOTES ON THE CULTIVATION OF MANGO IN INDIA.

The mango is cultivated in many parts of India. Generally dry climates produce fruits of a large size which are more fleshy and juicy and of better colour and flavour than those produced in moist climates.

A good plot of ground exposed to the morning sun, should be selected, well ploughed and thoroughly weeded out. Ploughing is necessary as it renders the nourishing elements in the soil more active.

Trees should be planted at an interval of from 35 to 40 feet from one another each way, so that the trees may have free ventilation and sunshine. Trees planted closer will grow slender, tall and branchless and in the rainy season the ground remains damp and will become a breeding place for all kinds of insect pests.

In the absence of facilities for irrigation a well should be dug up at a convenient place in the plantation.

PLANTING.

Pits should be dug up of the size of 3 feet by 3 feet at a distance of at least 35 feet from one another. The earth should be thrown round the pits and beaten to reduce it to fine soil, removing grass and weeds that it may contain. Three months after in the rainy season, say from June to October, planting may be commenced. If from want of rain the pits are dry they should be watered as much as the soil will take. After allowing some time to elapse to make the soil workable, the loose fine soil round the pits should be mixed up with a basketful of well rotten manure and a small basket of bone dust. This must be thrown into the pit to fill it in. A small hole should be made in the centre of each pit, to receive the ball of earth round the root of the graft. The pot containing the graft must then be brought over the hole and gently broken, care being taken that the ball is not disturbed. The plant must next be placed in hole up to the ring round the stem and the soil round must be gently trodden, the plant being held straight. A small embankment should then be made round the plant to keep the water in and the plant must be tied to a stake driven in next it, to prevent it from being shaken or blown down by wind. As the plant grows the embankment must be enlarged. It is important that the stem should not be buried too deeply in the pit thus making useless the operations of ploughing, weeding, etc.

PRUNING AND MANURING.

The plants should not be allowed to bear fruit until they are 5 years old. This is done to encourage them to full growth before yielding. The soil round the stem for a short distance should be dug up every year without injuring the roots and mixed with any available manure well rotten. After the fifth year the plant should be root pruned. The soil round the plant as far as the shadow extends at noon which gives roughly the extent to which

the roots have spread is hoed deeply, the internal roots and rootlets are cut without disturbing the thick root and the soil is removed to the extent indicated. The roots are then exposed for a month and the soil is then turned over, well beaten and mixed up with any manure available such as stable manure, farm-yard manure, night-soil, oil cake, and bone dust, and used to fill up the space hoed. An insufficient quantity of manure and only near the stem is not of any use. A sufficient quantity according to the growth and size of the tree should be spread over the surface evenly and well incorporated with the soil.

It must be noted that the manure used should be well rotten and of sufficient quantity.

After pruning and manuring in the absence of rain the trees should be copiously watered at least once a week. The usual plan is to water them when young and leave them to get water as best they might from any rain that may fall. If left unmanured and unwatered in summer the tree will not yield full crop every year for lack of nourishment. This is why we often find mango trees bearing one year and giving unsatisfactory crop for two or three years afterwards.

Trees should not be watered during the period of rest, i.e., from September to December, as by doing so a short forced growth resulting in leaves and not blossoms will be observed. Watering once a week when the trees are beginning to bear fruit is recommended and must be stopped when fruits begin to ripen.

If any disease attacks the leaves they should be sprayed with Bordeaux Mixture.

Young plants should be watered at least twice a week during the dry season.—Garden Guide of M. Rudrappa & Son.

PICKLING SEED.

The following directions for "pickling" are given in the Queensland Agricultural Journal and should apply to paddy or sorghum as well as wheat where there is danger from smut.

Mix 1 lb. bluestone with 5 gallons water in a wooden or earthenware tub by suspending the bluestone in a bag in the water for a night. Place the grain in a coarse cloth bag and dip into the solution, agitating the grain so that each seed may come in contact with the solution. Three minutes dipping is sufficient, then lift and allow solution to drain back.

Slake 2½ lb. quick lime into a cream, and add 22 gallons water. Transfer grain dipped into bluestone solution into fresh bag and dip in lime solution for two minutes. Drain and dry thoroughly.

Another method of treatment is as follows:—Spread the grain on the floor, sprinkle with a 10 per cent. solution of bluestone (1 lb. to a gallon of water) and thoroughly mix.

Then mix with air-slaked lime or wood ashes, seeing that every grain is coated over.

SOILS AND MANURES.

LOSS OF NITRATES IN THE SOIL.

All gardeners are aware of the fact that the nitrates present in the soil are reduced in quantity during the winter owing to their being carried away by percolation of rain water; but we imagine few cultivators have any idea of how great the loss may be in such a rainy winter as that which we have passed through this year.

In order to obtain accurate estimates of the loss of this plant food MESSRS. RUSSELL and APPLEYARD have kept records of the amount of nitrates present in soil during each month of the year. The loss is greatest on good and on light land, and least on heavy land; but on all it is considerable. Gardeners will note particularly that this loss of nitrate reaches its maximum in land that is in good condition and allowed to lie fallow during the winter. To give an example of the enormous reduction of nitrate which occurs on fallow land during the winter the following records may be cited.

A certain fallow plot at Rothamsted showed a fairly steady increase in nitrate from April to September. By the middle of the latter month the top 18 inches of soil contained 170 lb. of nitrogen per acre in the form of nitrate. This is equivalent to about 10 cwt. of nitrate of soda. The value of this stock of nitrogen at current prices is about £8. With the winter rains the nitrate begins to wash out. The loss is severe in November and December, and by February the accumulated store has been reduced to 50 lb. of nitrogen, the equivalent of 320 lb. of nitrate of soda. The £8 worth of nitrate with which the soil began the winter has been reduced to about £2 7*s*. worth—a money loss per acre of nearly £6 sterling. Inasmuch as large quantities of nitrogen are essential for the production of crops, and particularly for the crops grown in vegetable gardens it is evident that if this loss can be checked a vast sum of money will be saved. At present it has to be made good by the addition of nitrogen in one form or another. DR. RUSSELL suggests that green manuring by Mustard sown in September and dug in, will help to reduce the loss, and for our part we are convinced that this is a method which deserves wide application by gardeners. Last year experiments in green manuring suitable for the vegetable quarters of gardens were started at the R. H. S. gardens at Wisley, and though it will take some time before the results of the experiments can be available we feel hopeful that they will show that gardeners can do much, by a well considered system of green manuring, to reduce the loss of nitrogen from the soil they cultivate, and thereby increase the productiveness and profit of their crops. The use of a catch crop of this kind is, of course, to cause it to abstract from the soil a considerable quantity of nitrates which are returned to the soil when the crop is dug in. Much of the nitrogen contained in the catch crop is in the form of proteins and other compounds, which must first be decomposed before they give back their nitrogen in simple form, and hence these compounds are fairly safe repositories of nitrogen so far as the leaching effect of rain is concerned. Hence the use of catch crops in conserving the supplies of nitrogen in the soil.—THE GARDENERS' CHRONICLE.

EFFECT OF PHOSPHATES AND SULPHATES ON SOIL BACTERIA.

E. B. FRED.

The influence of inorganic fertilizers on the bacterial processes of the soil has not received much attention. For this reason a study of the effect of some of the pure salts of those elements which constitute an important part of commercial fertilizers was undertaken. The aim was to determine, if possible, the influence of phosphates and sulphates upon the activities of soil bacteria and to ascertain if the fertilizing effect of these substances could be explained in part by the promotion of bacterial action.

The following methods were employed: Rate of ammonification in solution and in soil; this was conducted with pure and with mixed cultures of bacteria. Aside from this, determination was made of the relation of the number of cells to the amount of nitrogen ammonified. To show this relation, plate counts were used. The nitrogen for ammonification was added to the solution in the form of peptone and to soil in the form of casein. The rate at which the nitrogen of these substances is converted into ammonia was determined by distilling with magnesium oxide. The cultures were incubated at room temperature and at different intervals the amount of ammonia determined.

Monobasic potassium phosphate in peptone solution caused a great increase in the production of ammonia. This is noted with a pure-culture yellow ammonifer and with a suspension of soil bacteria. The gain was greatest at the end of the first two days. Merck's precipitated calcium phosphate caused a slight increase in ammonification, but not nearly so large as the monobasic potassium phosphate. Sulphates of calcium and potassium increased ammonification to a small extent. The action of monobasic potassium phosphate was far greater than that of potassium sulphate. From this it seems that the potassium iron does not materially influence ammonification. The results of plate counts show that monobasic potassium phosphate causes an enormous increase in multiplication of bacteria. This is followed by a rise in ammonia. The ammonia production, however, is not in proportion to the number of bacteria. This seems rather to be a result of increase in the number of cells than increase in individual cell activity. All of the phosphates gave a large increase in the number of soil bacteria. There was only a slight increase from the sulphates. The same relative effect of phosphates and sulphates was noted in the case of carbon-dioxide evolution.

From the results of this work, as a whole, the following conclusion may be drawn: That possibly the increased crop production which results from the application of soluble phosphates is due in part to the promotion of bacterial activity.—Bull. Int. Inst. of Agric.

EXPERIMENTS ON "HUMOGEN" (BACTERISED PEAT).

Whereas the "humogen" or "bacterised peat" of Professor W.B. Bottomley is spoken of as a "new material," and the desirability of experimenting with it is being urged, on grounds of national importance, by

the Board of Agriculture and other public bodies, it appears to be entirely forgotten—or ignored—that experiments have been conducted with it at Woburn for the past two years. Already the Journal of the R. A. S. E. for the year 1914 has contained a long account of the work done with "humogen," while accounts of experiments with earlier inoculating materials, introduced by PROFESSOR BOTTOMLEY have been contained in the respective Journals for 1908, 1909 and 1910. It might well be urged on those now advocating the extended trial and use of the "new discovery" that they should read at least what has already been done at Woburn.

I now proceed to put out the results of last year's experiments with "humogen."

PROFESSOR BOTTOMLEY kindly sent me, early in 1915, a supply of "humogen" for experimental purposes. On arrival it was found that there were two different lots, one a good deal drier and less fibrous than the other, the latter being moister, darker in colour, and more resembling peat litter. Analysis of the two lots gave the following results:—

	Drier sample.	Moister sample.
Water	51·49	74·42
Organic matter	25·66	22·30
Mineral matter	22·85	3·28
	100·00	100·00
Total nitrogen	1·49	1·38
Nitrogen soluble in water .	·08	·48

It will be seen that there were considerable differences between the two lots, more especially in regard to the moisture and the soluble nitrogen, the moister sample being much the richer in the latter constituent. For this reason it was employed in the Pot Experiments in preference to the drier sample.

PROFESSOR BOTTOMLEY advised the use of the "humogen" in two different proportions, namely, 1 part to 9 of soil and one part to 19 of soil, each taken according to bulk and not to weight.

The "humogen" was mixed with the soil, the mixtures forming the top 9 in. in each pot.

In the pots employed the quantities of "humogen" used were 1 lb. per pot for the 1:9 treatment, and ½ lb. for the 1:19. The ordinary Woburn soil was employed, and it may be said that the amounts of "humogen" used worked out respectively at 35·6 tons and 17·8 tons per acre.

It was proposed to ascertain how the nitrogen made available in the peat by PROFESSOR BOTTOMLEY'S process compared in effect with that obtained from nitrogenous materials, such as nitrate of soda, supplying nitrogen in an available form. For this purpose a comparison was made on the basis of the soluble nitrogen in either material. The equivalent—in terms of the soluble nitrogen contained—of 1 lb. of the moister "humogen" was found to be 13·34 grammes of nitrate of soda, equivalent to a dressing of 20·9 cwt. of nitrate of soda per acre for the 1:9, and 10·45 cwt. per acre for the 1:19 treatment. The amount of nitrate of soda being so large, it was decided to put it on at intervals during the growing of the plants, in four equal dressings. The crops selected were oats, peas, and mustard.

OATS.

The seed was sown on April 27, 1915. There was no apparent difference as regards germination in any case. For the first month, however, the heavier dressing of "humogen" seemed to have an adverse action and to somewhat scorch up the plants. Later on, this effect disappeared. The dressings of nitrate of soda were applied on May 21, May 27, June 3, and June 5.

The peat treated plants tillered out much better than the untreated ones, these latter, on the other hand, being considerably taller, but more stalky.

The crops were cut on August 23, and the comparative results are given in Table I.

Table I.—Experiments with "Humogen" (Bacterised Peat). Oats, 1915.

	Corn.	Straw.
No treatment	100	100
"Humogen" 1:9	118	233·1
,, 1:19	131	189·6
Nitrate of Soda "humogen" 1:9 ...	119	175·2
,, ,, ,, 1:19 ...	127·7	170·1

It will be seen that there was a small increase of corn by the "humogen" treatment in both cases, but that this was no more than that produced by an equivalent amount of soluble nitrogen in the form of nitrate of soda. It cannot, therefore, be said that there was any increase of grain more than was due to the nitrogen actually supplied originally. In other words, there was no increase of corn resulting from any nitrifying action produced in the soil by the use of the bacterised peat.

On the other hand, the increase of straw (the green portion of the crop) was very marked, and was in excess of that produced by the nitrate of soda.

PEAS.

Nitrate of soda not being a suitable top-dressing for a leguminous crop like peas, this was omitted, and the two treatments with "humogen" were compared merely with untreated soil. The experiments were in duplicate.

Nine seeds were sown in each pot on April 27. The germination with the "humogen" treatment was, however, not satisfactory, and the peas seemed to rot in the soil.

In each of the untreated pots seven plants came up, but with the treated ones only four plants appeared, and re-sowing had to be done.

At first the treated plants were inferior to the untreated, but, later on, the former grew much better and seemed to be the more vigorous. The pods appeared earliest in the untreated set. The crops were cut on August 23, and the comparative results are given in Table II.

Table II.—Experiments with "Humogen" (Bacterised Peat). Peas, 1915.

	Corn.	Straw.
No treatment	100	100
"Humogen" 1:9	87·4	231·5
,, 1:19	124·4	185·6

The results are not at all uniform, and cannot be considered satisfactory,

inasmuch as the duplicates did not agree at all well, probably owing to the uneven germination.

It is therefore not advisable to draw any conclusion as regards the weight of corn, but it may be observed that the same point as was brought out in the case of oats, namely, the increase in the green portion of the plant, was very marked.

MUSTARD.

Twenty seeds were sown in each pot on April 27, 1915. The germination was quite regular in all the lots. The nitrate of soda dressings were given, as with the oats, in four equal applications. The young mustard plants to which peat treatment had been given seemed at first somewhat scorched, but, later on, they picked up and grew very vigorously, giving very luxuriant foliage of rich green colour, and being altogether much superior to the plants in the untreated soil. The latter all along retained a more stalky and less "bushy" appearance. The nitrate of soda plants were similarly much superior to the untreated but were not the equal of the peat sets.

The first green crop was cut on June 21, just as the pods were beginning to form. A second crop was then sown. This was cut on August 20 and a third lot sown on September 3, and cut December 3. The second and third crops showed, though in less measure (the crops being smaller), the same relative appearances as did the first. The results are given in Table III, and it may be said that throughout this experiment the duplicates agreed very well.

Table III.—Experiments with "Humogen" (Bacterised Peat). Mustard, 1915.

	1st crop (green weight.)	2nd crop (green weight.)	3rd crop (green weight.)	Total (green crop.)	Total (dry weight.)	Percentage.	
						Green.	Dry.
	Grms.	Grms.	Grms.	Grms.	Grms.		
Natural soil	106·46	42·10	37·30	185·86	43·49	100·8	100
Humogen" 1:9	713·85	189·52	64·70	968·07	175·04	520·8	402·5
"Humogen" 1:19	575·14	109·90	32·00	717·04	133·76	385·8	307·5
Nitrate of soda "Humogen" 1:9	515·27	163·58	37·72	716·57	144·98	385·5	333·4
Nitrate of soda "Humogen" 1:19	481·30	59·54	38·05	578·89	111·94	311·4	257·4

In this experiment a very clear advantage was gained by the peat treatment, this being more as the proportion of peat was increased. The crop, whether taken on the green or on the dry weights, was from three to five times the untreated, and the increase was in each case more than with the corresponding amount of nitrogen as nitrate of soda though this, in turn, gave from $2\frac{1}{2}$ to 3 times the weight of the untreated crop.

It would, therefore, seem that in the case of a quickly growing green-crop like mustard, there is a gain from the use of "humogen," and one more than can be accounted for by the soluble nitrogen supplied.

Putting together the results from the three crops grown this season, it would seem that, while there is no advantage to be derived from the use of "humogen" for grain production, it may fairly be said that, as regards the green parts of the plant, or a green-crop such as mustard, a marked benefit may be shown, so long, at least, as the plants are grown under conditions of greenhouse-cultivation and where they can be regularly watered and tended.

FIELD EXPERIMENT WITH "HUMOGEN."—OATS, 1915.

Simultaneously with the pot-culture experiments just recorded, another was made on a field scale, the plots in question being 3/40ths of an acre each. One of these plots was left untreated, and to the others applications from the two different deliveries of the Bottomley peat preparation were given at the rate of 5 cwt. per acre.

The experiment was carried out in Road Piece Field. The first ploughing of the land took place in January, and the second ploughing February 2–5, 1915. On April 9 "Abundance" oats were sown at the rate of 4 bushels per acre. The new crops appeared by April 24. On April 29 the top-dressings of Bottomley's peat preparation were applied. During the course of the season little or no difference could be seen between the untreated and treated portions. Owing to the drought the crops were very poor, the soil being very light and dry. The oats were cut August 23–24 and carted September 8. The results are given in Table IV.

Table IV.—Field Experiment on "Humogen" (Bacterised Peat), Road Piece. Produce per acre.—Oats, 1915.

	Head Corn.			Tail Corn.	Straw, etc.
	Weight.	Bushels.	Weight per Bushel.	Weight.	
	Lb.		Lb.	Lb.	C. q. lb.
1. No treatment	557	16·7	33·2	47	11 0 25
2. "Humogen" (dry sample) 5 cwt. per acre ...	427	13·1	32·7	53	10 2 21
3. "Humogen" (moist sample) 5 cwt. per acre ...	680	21·5	31·5	53	12 0 19

As regards the drier sample of "humogen"—this containing, it will be remembered, only ·08 per cent. of soluble nitrogen—the produce was below that of the untreated land both in corn and in straw.

The moister sample—which had ·48 per cent. of soluble nitrogen—gave results somewhat better than did the untreated soil, both corn and straw being higher. The increase in green produce was, however, nothing like that shown in the case of the crop grown under greenhouse conditions, and it is clear that if any real benefit is to be obtained, the "humogen" must be used in much larger quantities than 5 cwt. per acre. It may, of course, be the case that the very dry season of 1915 told much against success in the field.

The great difference between the two lots of "humogen," the one dry and the other moist, point to the likelihood of considerable variations occurring in the preparation of the material, with corresponding uncertainty in the results.

Putting together the conclusions to be formed from the Pot-culture experiments and from those conducted in the field, the position may, I consider, be fairly stated thus:—

Under conditions such as those obtaining in greenhouse cultivation, and where plants can be regularly watered and tended, a good preparation of "humogen" may produce a very marked increase in the growth of the green parts of plants and in the growing of green-crops, but it will show practically no benefit in the production of grain.

Under natural conditions of crops growing in the open, it has not as yet been established that, as regards the ordinary corn crops of the farm, any advantage is likely to accrue from the use of "humogen" when used in quantity such as a farmer is likely to be able to afford.—Journ. Royal Agric. Soc. of Eng.

ENTOMOLOGY.

REPORT OF THE ASSISTANT ENTOMOLOGIST

I was appointed to act as Assistant Entomologist to the Department of Agriculture in July last, and assumed duties on August 1st.

2. Since then the following expeditions have been made:—

(i) To Ulapane district to search for shot-hole borer on native-owned tea-gardens, August 12th.

(ii) To Dandagamuwa, N.-W.P., to investigate the attack of *Nephantis serinopa* on coconut palms, November 22-23.

(iii) To Galle to attend the meetings of the Board of Agriculture and Agricultural Society, November 29th to December 1st.

(iv) To Nawalapitiya, to ascertain whether shot-hole borer was present on Katawala Estate, December 16th.

3. In addition to these, regular monthly three-day trips have been made to Colombo to inspect the insect collections of the Museum.

4. MR. ALWIS, the Laboratory Assistant, has been engaged in looking after the insect collections, in general collecting and mounting of specimens, labelling etc. He has also begun keeping a record book in which details concerning all insects other than pests are kept. This record will be of great value in time to come.

5. The present collections of the section are poor both in numbers and in accommodation. The only order that is at all well represented at present is the *Rhynchota* (bugs). This deficiency is being made good as rapidly as possible.

6. All pests that are sent in or observed, are registered and preserved if they are in sufficiently good condition when received, and they are stored in a separate series from the general collections.

PESTS.

TEA.

7. *Homona coffearia Meyr. Tortrix* has undoubtedly been (apart from shot-hole borer) the most serious pest of tea during the year. Few complaints have been received of it, however; but this may be put down to the fact that planters are now more familiar with the pest and its ravages and not to any real reduction of its activities or its range. It has been very bad in Maskeliya which seems to be the most favourable district for its increase. It has actually been reported from the following places:—

Maskeliya in March and again in November, from Nanu Oya in May, from Bogawantalawa in June, from Kotagala in July, from Dolosbage in December and specimens were captured at Peradeniya in November and December. This pest is undoubtedly very widespread in the tea-districts, and it is probable that there is hardly an estate in the upcountry districts, at least, where a few specimens could not at any time be found.

8. One of the specimens from Dolosbage was found to be parasitized by a Hymenopterous larva which gradually grew to full size and pupated, the imago emerging about December 28th. This species appears to be the same as the one figured by GREEN (TROPICAL AGRICULTURIST, July 1905, page 194.)

9. In November, a number of Tortrix egg-masses were obtained from Maskeliya, through the kindness of Mr. C. M. Henry, and these were reared at Peradeniya under various conditions. The eggs all hatched on November 15th and 16th and the young larvæ were fed on mature tea-leaves in glass-bottomed pill-boxes for the most part. One egg-mass, however, was pinned to a leaf of a tea plant growing under natural conditions in a large wire-gauze experiment cage. Other egg masses were placed in a glass receptacle approximately 4 in. by 2 in. deep. The larvæ which were reared in the open air were observed to cluster on the under-side of the same leaf on which they hatched, and they made no attempt to migrate on to other leaves for several days, their numbers meanwhile getting greatly reduced. These larvæ spun webbing over the under surface of the leaf and lived under it, eating away the epidermis of the leaf. The number of times skin-shedding took place could not be observed. Only three of these larvæ reached maturity. They fed on old mature leaves throughout, the bush they were on being destitute of flush.

10. The larvæ which were reared in pill-boxes grew very slowly and did not thrive although a few moths were reared from them. One of these larvæ fed for 65 days before pupation and the moth emerged after 9 days.

11. The larvæ which were reared in the glass dish appeared to thrive best of all, pupating after 27 or 28 days and the moths emerging in another 8 days. This was probably due to the moisture in the food being better conserved than in pill-boxes.

12. An attempt was made by turning moths of both sexes into the experiment cage to induce them to breed, but with no success.

13. Several of the original egg-masses were dipped into "Vistolene" (a patent insecticide) and were put into a glass jar and kept stoppered up. Only one batch hatched, but one caterpillar managed to survive till the 10th December, and grew to a size of 7 mm. before it finally succumbed. It was given no food at all except the leaves which were put in with the egg-masses originally and yet it grew to this size. This result must be put down to the moisture contained in the leaves which enabled it to keep alive, as other caterpillars which were given only dry leaves lived only for 5 days.

14. These simple experiments, although very imperfect yet show to some extent the tenacity of life exhibited by the Tortrix caterpillar and may explain why it is so hard to get rid of.

15. *Zeuzera coffee*, Neitn. The Red Borer has been much in evidence. Reports have been received from the following places and times:—From Maturata and Neboda in January, from Wattegama in February, from Pelmadulla and Ratnapura in April, from Pelmadulla in May, from Yatiyantota in August, from Uda Pussellawa in September, from Halgranoya and Dehiowita in October. This pest appears to do real damage only when it occurs in numbers in tea nurseries, where it may destroy a number of plants before any harm can be detected. In adult tea it cannot cause so much injury, as it merely destroys single branches. Unfortunately, however, it appears to prefer seedling plants to anything else, and most of the reports that have come in, have referred to this type of injury. When a seedling is attacked, it is commonly hollowed out almost to the end of the tap-root, the only trace of the mischief being the gradual wilting of the leaves as the sap is slowly cut off.

16. *Heterusia cingala*, Moore,. The Red Slug has been reported from Badulla in March, from Ulapane in April, from Matale in August and from Madulkelle in November.

17. In the Matale case, the grubs were complained of as stinging coolies who were tapping rubber interplanted with tea, and thus hindering them. As these larvæ are quite devoid of urticating hairs (unlike the "Nettle-grubs" *Limacodidæ*), there must have been some error of observation. As the correspondent seemed rather positive that his coolies' complaints of their stinging properties were well-founded, the writer took the opportunity of testing the alleged stinging powers on his own person but completely failed to induce any indication of their existence. It appears likely that true nettle-grubs were also present on the tea but none were sent in.

18. The attack in Madulkelle in November appears to have been a somewhat serious one, the correspondent having complained that the grubs appeared very suddenly in tremendous numbers and spread from field to field very rapidly in spite of turning on coolies to hand-pick the caterpillars. The moths emerged and commenced egg-laying in the latter part of December, but after this, the pest appears to have disappeared almost entirely for no obvious reason. Doubtless the natural parasites of the species have increased to such an extent as to reduce the outbreak to reasonable dimensions.

19. *Natada nararia*, Moore. Outbreaks of this nettle-grub (and possibly other species) were reported from Namunukula, Madulsima and Pelmadulla in October. In the case of the Madulsima visitation, the outbreak was said to extend over an area of about twenty acres. The affected bushes lost 70-90 per cent. of their mature leaves and this, of course, re-acted adversely on the production of flush although the latter was not eaten. Later, the correspondent reported that the advent of the N. E, Monsoon had caused the pest to disappear almost entirely, without any special measures being taken to suppress it. The same thing occurred in the case of the Namunukula outbreak, i.e., the pest disappeared with the heavy rain. An attempt was made in the Laboratory to rear the specimens of the caterpillars to maturity, but it was found extremely difficult as the caterpillars appeared to be all affected with some disease and died off at a tremendous rate. A caterpillar which appeared perfectly healthy became, in a few hours, a jellified mass. Two Hymenopterus parasites were reared from the caterpillars.

20. Cockchafer grubs (various *Lamellicorn* larvæ) have been reported as injuring tea from Talawakelle in August, from Galaha in September and from Ragalla in November. In the latter case, the grubs were said to have destroyed a thirty-acre field, though this was doubtless an exaggeration. In nurseries of seedlings cockchafer grubs may do a tremendous amount of damage, as they eat away the entire root-system. It is probable that, when this occurs, it is because the plants have been manured with fresh cow-dung, as this has a strong attraction for the pest.

21. Mites have been reported from tea very seldom during the year. The only records are of the Purple Mite (or Ribbed Mite) *Phytoptus carinatus*, Green, reported from Lindula in May and from Galaha in September.

22. *Helopeltis antonii*, Sign, the "Tea-Mosquito" has not been much in evidence, the only records being from Ramboda in August (this is somewhat doubtful, as no specimens of the insect were sent, but only punctured leaves) and from Nawalapitiya in October.

23. Only one report was received of the Tea-termite, *Calotermes militaris* from Bogawantalawa in March.

24. Among the minor pests of tea, the following have been sent in:—

Bag-worms (*Psychidæ*) (sp. incert) from Ulapane and Galle district in May and from Ratnapura in June.

25. The Leaf-roller (*Gracilaria theivora* Wlsm.) from Demodera in February and from Kandapola in March.

26. Tea Leaf-mining fly (*Oscinis theæ*) from Rangalla in January and from Ramboda in September. This insect is found on every tea estate and cannot be considered a pest, but the sinuous grey lines which mark the course of the larva are sometimes taken for a new *fungus disease.*

27. *Orgyia Postica*, Wlk. The small tussock caterpillar or "Vapourer moth" has been reported from Gampola in October and from Badulla in December. This pest usually starts on Albizzia or some other plant and takes to the tea when it has grown numerous. Its parasites usually keep it in check.

28. *Stauropus alternus.* The Lobster caterpillar has been recorded from Kotagala and Maskeliya in October—isolated specimens in each case.

29. *Dasychira horsfieldi*, the large yellow tussock caterpillar. Some empty cocoons of what was probably this species were sent in, in October, from Kadugannawa. They were said, however, to be confining their attack to Dadaps.

HEVEA.

30. Para Rubber appears to maintain its almost complete immunity from insect ravages up to the present, such pests as have been reported during the year being either scarcely pests at all or confining their attacks to sickly or diseased trees. No reason can be assigned for this other than the one put forward by Green some years ago, e g., that the latex acts as a strong deterrent against any attempt to penetrate the bark. The following pests have been reported :—

Mariælla dussumieri, the rubber slug—was reported as drinking latex, from Udugama in March.

31. *Scolytidæ* (Boring beetles) have been reported several times. On investigation, however, it has always appeared that the borers attack only unsound bark and are probably attracted by the fungi which grow in it and not by the bark or wood. The following reports have been sent in :—

From Mahawella in March, from Haldummulla in April, from Ratnapura in October and from Galboda and Matale in November.

32. *Lecanium nigrum*, the Black scale insect. This pest was reported from Puwakpitiya in August and from Kurunegala and Mirigama in October, but in each case it appeared to do little harm.

33. *Batocera rubus.* Root and stem borer was reported from Pelmadulla in November, when it was taken from the stem of a rubber tree which had fallen down through the damage done by the grub.

COCONUTS.

34. *Nephantis serinopa*, Meyr. The Black-headed Coconut caterpillar. A serious outbreak of this pest has taken place in the North-Western Province, within which it has been reported from the following localities :—

From Marawila district in June, Kirimetiyana in August, Dandagamuwa in October and Chilaw in October.

35. In November, I visited Dandagamuwa and inspected the infested estate and obtained many of the insects in the immature stages for rearing. I found a high percentage of the pupæ were parasitized by Chalcids (two species) and by a Braconid parasite. A fair number of moths were reared from the pupæ obtained but it was found very difficult to induce the larvæ to feed in captivity.

36. *Rhynchophora ferruginea*, the Red Beetle. This pest was reported from Kosgoda (Southern Province) in June, and was observed at Peradeniya in December. Unfortunately, however, the fewness of reports of it can hardly be taken as a gauge of the pest's activities although they may indicate to some extent that the pest has not been quite so troublesome as usual. As in the case of Tea-Tortrix, this insect is now so well known that coconut planters do not consider it necessary to send in specimens.

37. The only other insect that has been observed in connection with Coconuts is the Scale-insect, *Ceroplastes actiniformis*, a specimen of which was found on a coconut frond at Peradeniya in November.

PADDY.

38. Paddy stem-borer (sp. incert) was reported from Katugastota in February.

39. *Leptocorisa varicornis*, the rice sapper or "Paddy fly" was reported at Ganoruwa Experiment Station in December, when it appeared in strong force just before the paddy grain "set," and appeared likely to reduce the yield greatly. Hand-nets were employed to reduce their numbers and the pest speedily disappeared almost entirely, though it is, of course, impossible to say how far this result was due to the hand-netting.

40. Previous to using hand-nets, a large net was tried, worked by two men who ran up and down the bunds holding the side-ropes of it, but this method was not found to answer owing to the cumbersomeness of the net and the narrowness of the bunds.

FRUIT AND VEGETABLES, ETC.

41. The Geometrid moth *Thalassodes quadraria* was reported as feeding on Mango in August. A Leaf-miner and a leaf-roller (spp. incert) were recorded from the same in September. The Chrysomelid beetle *Monolepta orientalis*, Jac. was reported as doing a lot of damage to the flowers of Mango at Bandarawela in October.

42. The Scale-insect, *Oudablis solani* Green, was reported from Kurunegala in April, as infesting Brinjal.

The Lace-wing bug *Urentius echinus* was sent in from Matale in August, from the same plant. A shoot-borer of Brinjal was observed at Peradeniya in December, but could not be reared to maturity. It was probably *Leucinodes orbonalis*.

43. A caterpillar-borer (sp. incert.) of Potato was reported in September. The locality was not mentioned.

44. Tomatoes were sent in from Matale in October affected with some pest. Many maggots being present in the rotten fruit. Fruit Flies were suspected, but on rearing the larvæ to maturity a species of *Drosophilid* fly emerged and no true fruit flies (*Trypelidæ*). In this case, it is probable that the fruit was first attacked by fungus disease, the Drosophilids merely utilising the rotten fruit as a breeding ground and not being the primary cause of its going rotten.

45. Rhubarb and Turnips were reported to be attacked by the vegetable-eating ant, *Dorylus indicus* in Maskeliya in March.

46. *Sesbania grandiflora* (Agathi) was reported as being defoliated by the caterpillars of *Terias silhetana* in August. (Locality not reported).

47. *Cajanus indicus* was severely attacked by a Mealy-bug (*?Dactylopius* sp.) which formed a white mat on the under surface of the leaves, at Peradeniya in September.

48. *Gliricidia maculata* was attacked mildly by the "nettle-grub" larva of *Belippa laleana* at Peradeniya in September.

49. Guava leaves were observed to be punctured by the bug *Disphinctus formosus* at Kandy in October. This bug is allied to the *Helopeltis* of Tea and Cocoa and works in the same way.

50. The Chow-chow creeper was reported as being infested with a species of Aphis in November.

51. Citrus has been reported or observed to be affected with the following pests:—

"Shot-hole Borer" (*Xyleborus* sp.) at Haldummulla in June, with a species of *Aphis* at Peradeniya in November and with Mites *Acarinæ* (on the bark) at Ambalangoda in December. An attempt was made to "inoculate" a small Citrus tree at Peradeniya with some of these mites, but it failed, and it is probable that the presence of the mites on the bark of the diseased tree was secondary on some other cause. In this, as in most cases where pests are sent in for report, a totally inadequate quantity of material was furnished, while the particulars given were not sufficient for the purpose of investigation.

52. A Plantain root-stock was sent in from Gampola in November, bored by weevil-larvæ, probably those of *Odoiporus longicollis*. Two Aphides were found in one of the tunnels.

53. *Tobacco.* No reports have been received of insect-injury to growing Tobacco, but the cheroot-beetle (*Lasioderma serricorne*) has been much complained of as attacking dry tobacco in the Dumbara Valley. In September a number of small beetles (Fam. *Trogositidæ*) were sent in with dry tobacco leaves supposed to have been injured by them. On confining the beetles with a quantity of tobacco, they refused to touch it, either in the adult or larval stages. When specimens of *Lasioderma serricorne* were put in with them, however, they greedily devoured them. Specimens of *Araecerus fasciculatus* which were put in were also killed and eaten. It therefore appears probable that the trogositids (probably a species of the genus *Tenebroides*) act as enemies of the cheroot-beetle and other pests of dried products and are, therefore, to be regarded as beneficial insects. The larva of the species is crimson in colour, with black head, black dorsal patch on the 1st thoracic segment and two black spots on each of the succeeding thoracic segments.

GREEN MANURE PLANTS.

54. *Albizzia* sp. was reported as being attacked by scarlet mite (sp. incert) in February at Bandarawela, by "Shot-hole Borer" (Xyleborus sp.) at Matale in June, by *Terias silhetana* at Balangoda in September, and at Ratnapura in November, and by bark-eating Borer (*Arbela quadrinotata*) at Neboda in September.

55. *Tephrosia candida* was attacked by "Mealy bug" (sp. incert, probably *Dactylopius* sp.) at Punduloya in May and, in common with tea, at Namunakula and Demodera in December. In the latter two cases, the Tephrosia had become severely infested with the mealy-bug which had then taken to infesting the tea. This gives a good example of the danger of neglecting any prominent outbreak of an insect-pest especially when it makes its appearance in the neighbourhood of cultivated crops.

56. The pods of *Tephrosia candida* were found to be bored by the Pyralid moth *Etiella zinckenella* at Halgranoya in October. The correspondent who sent this in, inquired whether the boring was due to "shot-hole borer."

In December, pods were sent in from Peradeniya, infested with all stages of *Araecerus fasciculatus*.

DADAP.

57. The Paddle-legged Bug (*Anoplocnemis phasiana*) was reported from Balangoda in April and from the Walapana District in June.

58. *Terastia meticulosalis*, the Dadap shoot-borer has been reported from Balangoda in April, from the Walapana District in June, from Ratnapura in September and from Maskeliya in October.

59. Other pests of Dadap which have been recorded are the following:—*Agathodes ostentalis* from Ratnapura in September, *Dasychira horsfieldi* (?) from Kadugannawa in October, *Cyclopelta siccifolia* from Ganoruwa, Peradeniya, in December.

MISCELLANEOUS PESTS.

60. *Anthrenus vorax* was reported as damaging brushware by a Colombo Firm in May.

61. *Araecerus fasciculatus* was found to be infesting a packet of dry Jak seeds which were on exhibition in the Economic Museum at Peradeniya. They appeared to be in a very thriving condition despite the presence of a large quantity of powdered Naphthalene which was in with them.

62. A Gad-Fly, *Haematopota singalensis* was reported by the Government Veterinary Surgeon as annoying cattle at Matale in September.

G. M. HENRY,
Assistant Entomologist.

THE FLOUR OF LOTUS
(*NELUMBIUM SPECIOSUM.*)

PELLEGREFFI MARIA.

The flour obtained from the root of the Lotus is in great favour with Orientals. The plant is a perennial acquatic with a large white fleshy cylindrical rhizome having a polished shining surface.

The plant is easy of cultivation and grows rapidly without requiring special conditions of climate or surroundings. It grows also fairly well in some parts of Italy. The writer considers the cultivation of this plant to be worthy of trials in marshy regions in Italy.

The flour is made by the Chinese who value it both as a food and as a medicine.

It is pinkish white in colour, greasy to the touch, and crackles when pressed between the fingers. It is similar to arrowroot in appearance and under the microscope resembles potato flour. It cannot be confused with the latter since the granules are somewhat smaller, more regular in shape and the hilum is longer and not excentric.

To extract the flour, the rhizomes are first dried, then macerated in cold water for 3 days and nights. It is then reduced to a paste by pounding in a mortar and again treated in cold water. After decantation the paste is exposed to the sun and dried, after which it becomes first quality Lotus flour.—BULL. INT. INST. OF AGRIC.

CO-OPERATION.

FORMATION OF THE SEEDUWA CO-OPERATIVE CREDIT SOCIETY.

Director of Agriculture's Speech.

The Mudaliyar has called this meeting of Co-operative Credit Societies to-day in order to try and improve the agricultural position of the people of Seeduwa and the neighbourhood. Now, there are three ways in which those who are in authority and have the power can improve the condition of the people, when they are agricultural people like those of this district. The first is by education. But, of course, that only applies to the young; to boys and young men you can teach in a school something more about the soil and the plant than they knew before. A school has been opened at Peradeniya where there are seventy students learning about agriculture. But you cannot expect grown up men to go to school and so the second way that we have of trying to improve the agriculture of a district is by demonstration. We have in the Island various experiment plots and a number of school gardens where can be seen the influence of improved methods of agriculture. The third method, which I want particularly to speak about to-day, is to try and improve the financial position of the villagers. Most of the villagers remain heavily in debt and you could not do much to improve their condition till they are taken out of that. Now I am going to read to you a short paragraph from the London Times. It is an account of a lecture given in London by the Agricultural Advisor to the Government of India and it is an account of the demonstration farms that are being established all over India, Mr. MacKenna said that as a result of this movement the annual increase in the value of the agricultural products of India amounted to 2¼ million sterling; that is to say, the people by seeing how to grow crops better than they knew before were able to secure from the land about 34 millions of rupees more than in other years. Then he ends up by saying that in the union of the movement with that of Co-operation lay the economic future of India. I am quite certain that herein lies the economic future of Ceylon also. Now, you see, it is not a new thing which the Ceylon Government is trying to establish here in Ceylon. It is a thing which exists in India, in England, in Ireland and all over the world. I will explain shortly what Co-operative Credit Societies are for, and will begin by telling you what they are not for. They are not like a company for making money. A Company is a collection or a combination of people who put their money together in order to try and make good profits. But a Co-operative Credit Society is a society for saving money and it is a society by which those who belong to it can get more for the money they spend than they did before. Now, it is very important that you should understand that clearly and not expect that you are going to join the society and get big dividends; because if a Co-operative Credit Society is one for making money, it makes it out of its own people. That is one thing. Then there is one thing more: it is not a charitable institution. It is not meant for the rich

men of a district to come and give money to the poor. You do more harm to a Co-operative Society by giving money in that way than good, because one of the principal things about a Co-operative Society is to try and teach people to co-operate; that is work together to help themselves. What we want our well-to-do and influential residents is to help the movement and try and explain to the people what it is about; and I don't think any movement is more worthy of the influence of residents than trying to help on this world-wide one of Co-operation. Now, I have talked about Co-operative Societies and there are many sorts.

This is going to be a Co-operative Credit Society and, therefore, it deals with money. What you are going to do is to form yourselves into a little bank. Now, I want you to think of that word "Credit." What does credit mean? It means this. It means the amount of trust that a big bank will give to any person. Big banks are the people who have control of the money and if we want to do anything here in Ceylon or in any part of the world we have got to come to the banks and ask them to lend money. When a man is well off the bank will lend him money. We must remember that all enterprises and work is carried on under a system of borrowing money from somebody, and the rich man can borrow money at 7 per cent. because his credit is good. The banks says "We know this man; he has got plenty of money and houses and property and we can lend him money at no risk." But if anybody who is poor, say from this village, were to go to a Colombo bank, say the National Bank, and say "Lend me fifteen rupees," they would probably turn him out of the bank and certainly would not give it to him. They could not risk that sum because he is unknown and has no credit. If they gave him fifteen rupees he could go back to the village or go anywhere he liked and they would lose him. The bank cannot look after these small people, who have to borrow 10 and 15 rupees; and so you see the villager, if he wants to borrow money, must go to somebody who takes risks, and when a person takes risks he wants well paying for it. Now, you understand what credit is. Although the bank would not trust one man perhaps of this village, or one small villager, who has no lands, it trusts the whole village. It would say "yes, one may run away but the whole village will not run away;" and this is where we come to co-operation. You put all your credits together not individually and separately. I speak of a bank, because it is a convenient thing to do, but the same holds true of big firms or institutions in Colombo or anywhere else. They would not give credit to people in the village whom they don't know anything about, and so if a villager wants anything he has got to go and pay twice and three times the value of it. But it is not enough for a village to say "We will co-operate and join together for this purpose." It is necessary that when they join together they must have some legal standing and so the Government has made a law in which it says when seven or eight persons in one village want to join together they may become legally recognised. They become then a society. Now I have tried to explain what a Co-operative Credit Society is. The next thing to explain to you is what it is going to do. It is going to get money from somewhere and lend out to members at a low rate of interest. As I told you before, it is going to be a little bank really. Now, there are three ways by which a Co-operative Credit Society can get money. The first way and the most important is for every member to subscribe something. No one can be a member of a Co-operative Credit Society

that has not paid a subscription of something. So when you start, say that you have 500 members of a rupee each, you start with 500 rupees. That is one way. The second way is to get people who live near or even in Colombo and far away, who know you—to get them to put money into your little bank on deposit. People put money in the Savings Bank and they get 3 or 3½ per cent. interest. But when they put money on deposit with the society the society can pay them 4 per cent. So you see that it is a good business for the depositors; and as the society is registered according to the law and is, as matters stand, looked after by Government officials, it is almost as safe as the Post Office. That is the second way in which a society can raise money. If this society raises 500 rupees by subscription it ought to be able to raise 500 more by deposits. Some people will put five rupees on deposits, some 10, some 20, some 50, some perhaps 100. Everybody who wants to help the society can put a little money on deposit. These depositors have nothing to do with the management of the society. They have only to get 4 per cent. interest.

The third way of getting money is go to the Government. The Government has put by two lakhs of rupees this year for loans to Co-operative Credit Societies. And if you have paid up 500 rupees you can get 500 rupees from the Government. So you see you can get altogether 1,500 rupees. Very well. I have explained to you how you can get money; now, what are you going to do with the money when you have got it? That is the next thing.

You must lend it out to members of the society. If some member wants to do anything, say to buy some buffaloes or some bulls or ploughs or put up a fence, or to do something or other, it is the business of the society to lend him money. Members of the society have the right of borrowing money without security. No security is required. That is a very important thing to remember. If you go and borrow money from the bank they will say—What are you going to give as security?" But in a Co-operative Credit Society no security is required.

I have explained to you, what a Co-operative Credit Society is, how it is to get money and what it is to do with it. Now I am going to tell you who can belong to it. Well, every member in this village has a right to belong to this society. But people from other villages have no right. That is to say, if you say this is the society for a certain village or for a certain number of villages, people from other districts cannot come in. I dare say you will ask me this question: "Is anybody in the village to come in?" And then I have to say not everybody. A man may be very poor, but he must be a man of good character then he is to come in and he has got just as much right, just as much voice, as the richest man in the society. His vote will have the same value in the election of the Secretary, the President and other officers; the only thing required is good character. So you see what an extraordinarily clever and wise thing this law is. It simply amounts to this. There are lots of people in Ceylon who have got no money and property and, therefore, no credit. But we make this law and so long as a man has a good character he shall have just as much credit as the richest man in Ceylon. I want you to try and understand that thoroughly. That is the root of the whole thing. The society borrows money at 4 per cent. and lends out to members at 8 or 10 per cent. You see the society is making money and the members of the society are getting it if they want it at a very cheap rate of interest.

Now I want to come back to this question of character again. I have explained to you what a Co-operative Credit Society is. It is as good as the Savings Bank, and the reason is that everybody in that society is a man of good character. And if he is not a man of good character he won't be admitted into it. And if after he is admitted he does not pay his debts or something of that kind, he is turned out. The very fact of your belonging to a society is a sort of certificate for you. It is a guarantee that your enterprises are recognised and that you are an honest man; and when a man is in a society he is very careful not to do anything dishonest and get turned out. In this way the society maintains as it were automatically its reputation. Further than that, I will tell you what they are doing in India. In India the Committees of Societies are being empowered by the Government to try petty cases, so that instead of sending a man to the Police Court his case is inquired into by the Committee of his society. And as these Committees are elected by the people, the members themselves, a form of democratic government is growing up. And very often now in India, and also in other parts of the world, when a man gets into trouble in the Court he is asked if he is a member of the society, and if the man says "yes" so much comes to count in his favour because if you are not a good man, you can't join a society. And if he says "no," they ask why not? Well I need not go any further with that.

There is a great deal, of course, to explain to you about the working of these societies. But that would take a lot of time and I won't say anything more about it just now, but I will conclude with one word. I want you influential men, the residents of this district, to try and explain to your neighbours all about the Co-operative Credit movement, and help your Mudaliyar who has been very successful in other parts of his Division in making Seeduwa an important and prosperous society so that we can tell other people about it. It requires the earnest efforts of you men, who are well-to-do and influential, and whether you are Christians or Buddhists or Hindoos or Mohammedans, you cannot do better work than try to help your poor neighbours.

CO-OPERATION IN RUSSIA.

The Russian co-operative movement celebrated its jubilee last year. It was born during the epoch of great reforms—the emancipation of the serfs, the creation of the Zemstvo administration, and of Courts accessible to all. The first co-operative organizations date from this epoch. On October 22nd (old style), 1865, the statutes of the earliest loan and savings association were ratified. The founder of this association was S. F. LUCHININ, of Kostroma. In the same year N. V. VERESTCHAGIN founded the first cheese dairy union (*artel*).

From the first appearance of the co-operative movement, the Zemstvos extended to it their protection, but did not at once take an active part in the development and diffusion of loan and savings associations. Only in the seventies did the Zemstvos begin to assign sums from their resources for the establishment of associations, to which also they granted loans for the mutual responsibility of the participants. Between 1870 and 1880 these credit co-operative societies began to spring up in large numbers, at the rate of 120 to 170 annually. Towards the end of the seventies the development of loan

and savings associations proceeded less rapidly, but this did not imply any decline of the Zemstvos' interest in the movement. On the contrary, detailed information about the associations was collected, and congresses of co-operative workers were organized.

CREDIT ASSOCIATIONS.

By a regulation of 1895 a new class of association was created—the so-called credit associations. Moreover, associations were permitted to conduct intermediary operations, and their loan powers were extended. But the process of ratifying their statutes remained unchanged, and it was only after the promulgation of the regulations of 1904, which introduced new procedure greatly simplifying and accelerating the ratification of the statutes, that the increase of associations became rapid. The development of credit co-operative societies was also promoted by the grant to Zemstvos of the right to open associations on their own authority.

As the result of this new legislation, during the past ten years there has been created a solid organization of popular credit in Russia. Whereas on January 1st, 1905, only 1,434 associations were operating, on January 1st, 1915, there were 14,548—i.e., their number had increased ten times.

At the present time co-operative societies embrace more than a third of the population of the Empire. Their importance in the life of the peasantry is enormous. Their activity is not limited to the supply of the inhabitants with floating capital; they also help to diffuse the use of improved agricultural machinery and tools among the agricultural population, and to improve agricultural methods. Their cultural and educational activity, as manifested in the establishment of libraries, schools, people's palaces, and so forth, also deserve mention.

IMPORTANCE IN WAR TIME.

Their importance is especially great at the present time. The participation of the co-operative societies in the business of providing the army and population with foodstuffs, as also in the preparation of all kinds of necessaries for the troops, is in the highest degree valuable. But it must be admitted that lack of organization at the beginning of the war did not unfortunately permit them to realize to the full all of what a thoroughly disciplined people is capable.

In view of the poverty of the Russian country in cultural resources, the functions of the co-operative societies at the present time are highly diversified and scattered, comprising not only credit operations but many others. It may be anticipated that this question will settle itself in the near future. Bitter experience has aroused in the population a sense of public responsibility and has encouraged the development of independence. The passage of a co-operative law will place co-operation upon firm ground, and it is to be hoped the time is not far distant when the associations, amalgamated into unions, will embrace not one-third but all of the Russian people.—

The Times Russian Supplement.

The great trouble with kapok, the cotton of the silk cotton tree, was, up to recently, that it could not be converted into fibre for spinning, the fine fibres being reduced to dust in the early stages of carding. Lately, however, a carding machine has been introduced which arranges the fibres parallel to each other without breaking them, and then heats the sheet of wadding that is formed, causing the fibres in it to curl and interweave. In spinning, a liquid is used which causes the fibre to agglutinate without losing any of its properties, a yarn being formed which can be woven.—West India Com. Circ.

GENERAL.

CEYLON AGRICULTURAL SOCIETY.

ANNUAL MEETING 1916.

At the Council Chamber, Colombo, on 6th June, 1916.

The Annual Meeting of the Ceylon Agricultural Society, for the year 1915-1916, was held at 12 noon on Tuesday, the 6th June, 1916, at the Council Chamber, Colombo.

HIS EXCELLENCY THE GOVERNOR, presided.

There were also present:—THE HON'BLE THE COLONIAL SECRETARY, HON'BLE MR. J. G. FRASER, HON'BLE MR. W. C. S. INGLES, HON'BLE MR. R. B. HELLINGS, THE DIRECTOR OF AGRICULTURE, GOVT. AGRICULTURAL CHEMIST, GOVT. BOTANIST AND MYCOLOGIST, ACTING SUPERINTENDENT OF BOTANIC GARDENS, ASSISTANT ENTOMOLOGIST, GOVT. VETERINARY SURGEON, TOBACCO PLANTER, MANAGER, EXPERIMENT STATIONS, CONSERVATOR OF FORESTS, DIRECTOR OF EDUCATION, COUNT DE MAUNY TALVANDE, SIR SOLOMON DIAS BANDARANAYAKE, SIR PONNAMBALAM ARUNACHALAM, DR. H. M. FERNANDO, LT.-COL. T. G. JAYAWARDENE, DR. JOSEPH PEARSON, MUDALIYARS A. E. RAJAPAKSE, S. WEERACKKODY, TUDOR RAJAPAKSE, J. A. WIRASINGHE, E. B. GUNATILLAKE, OSWALD TILAKARATNE, J. H. MEEDENIYA DISAVA, MESSRS. FRANCIS BEVEN, A. W. BEVEN, JAMES PEIRIS, W. A. DE SILVA, A. BRUCE, H. L. DE MEL, K. BANDARA-BEDDEWELA, J. D. VANDERSTRAATEN, A. CANAGARATNAM, DANIEL JOSEPH, C. B. BRODIE, B. A. STARLING, N. WICKREMARATNE, Agricultural Instructors MOLEGODE, KARUNANAYAKE and MADANAYAKE, and the Secretary (MR. C. DRIEBERG.)

Before the formal business was taken up, an Address of Welcome to HIS EXCELLENCY THE GOVERNOR was read by the HON'BLE THE COLONIAL SECRETARY representing the Board of Agriculture.

MR. DENHAM paid a high tribute to MR. HARWARD, late Director of Education, a Vice-President of the Society, on his retirement from the Government service.

Minutes of the previous meeting were read and confirmed.

Extracts from the Annual Report were read by the Secretary and on the motion of MR. FRANCIS BEVEN, seconded by DR. H. M. FERNANDO, the Report and Statement of Accounts attached thereto were adopted.

HIS EXCELLENCY expressed his desire to associate himself with what MR. DENHAM said regarding MR. HARWARD'S enthusiasm, loyalty and devotion to duty. He hoped that members recognised that in so far as the work of the Society was concerned it was fortunate in securing as MR. HARWARD'S successor one who was the first Secretary of the Society.

HIS EXCELLENCY then withdrew and the Director of Agriculture took the Chair.

MR. D. S. CORLETT read a paper entitled "Tropical Agriculture under Irrigation." SIR PONNAMBALAM ARUNACHALAM, LT.-COL. JAYAWARDENE, MR. W. A. DE SILVA, and MUDALIYAR WEERACKKODY offered remarks to which MR. CORLETT replied. The Chairman then summed up the discussion and asked that the other two papers "Future of Rural Agriculture in Ceylon" by MR. ARTHUR DE SILVA and "Agricultural Improvement in Headmen's Divisions" by MR. WICKREMARATNE already circulated among members be considered in association with MR. CORLETT'S paper.

The Secretary's paper "The Agricultural Possibilities of Delft" was also taken as read.

Sir Ponnambalam Arunachalam moved "that the meeting do authorise the Secretary to request Government to make available to the members of the Society the Report of Mr. Strange on Irrigation in Ceylon or a summary thereof." Mr. W. A. de Silva seconded and the resolution was carried.

Dr. Fernando moved that a Committee of this Society be appointed to investigate the question of developing land under the Irrigation Tanks in the Dry Zone and submit their suggestions to the Board; the Committee to consist of Mr R. N. Lyne, Sir Ponnambalam Arunachalam, Mr. Kelway Bamber, Mr. W. Arthur de Silva, Mr. H. L. De Mel, Mr. D. S. Corlett, Dr. H. M. Fernando and Mr. C. Drieberg, with power to add to their number." Mr. A. W. Beven seconded and the motion was adopted.

With a vote of thanks to the Chair the meeting terminated.

C. DRIEBERG,
Peradeniya. Sec., C. A. S.

INDIAN SALTPETRE.

In order to obtain some knowledge of the biological factors involved in the production of saltpetre in the soils of Bihar experimental work was carried on last year by the Imperial Agricultural Bacteriologist at Pusa (Mr. C. M. Hutchinson). Information was sought for on the following points:—

(1) Why does this industry flourish in particular localities?

(2) Could it be extended either in the places where it is already established or into other districts?

(3) Could the methods of recovering the nitrate from the soil be made more efficient?

The enquiry is still in an early stage, but it seems clear that the leading factors in determining the localities in which this industry can flourish are (1) a high percentage of lime in the soil, (2) suitable climatic conditions for (*a*) nitrification of organic matter, (*b*) accumulation of the nitrates formed.

"These conditions," says Mr. Hutchinson in his Report for 1914–15 just issued, "are fulfilled in several districts throughout India, including the Punjab and the United Provinces, but it is in Bengal and especially in Bihar that they are most favourable. It has been ascertained that nitrification goes on during the monsoon in soils containing much nitrogenous organic matter such as occurs in the neighbourhood of villages, and that concentration of the nitrates formed is prevented by the rainfall which carries them down, and allows production to go on in the soil stratum in which conditions of food supply and aeration favour bacterial action, which would, however, be interfered with by accumulation of nitrate beyond a certain concentration. Such a concentration is found in some of the saltpetre earth collected for extraction by the *nuniahs* and as it is of an order many times greater than that necessary to inhibit nitrification, it is clear that it has not been produced *in situ* by this process, but has been arrived at by the evaporation of weak solutions of nitrates from the soil surface either in the field or on the walls of houses."

"The *nuniah* collects *nuni-mati* or saltpetre earth from haphazard sites selected with reference to the accumulations of nitrogen characteristic of village sites and cattle sheds; hence he is dependent on uncontrolled supplies of raw material and any expansion of the industry could only be effected either by introducing the *nuniah* into hitherto unexploited districts or by

artificial nitrification of nitrogenous organic matter which would otherwise serve some other purpose. An attempt is now being made to discover the extent to which the carrying out of this latter alternative is feasible. Local enquiry has elicited the fact that the *nuniah* does not generally make his business pay until the second or third year, which he attributes to the fact that the amount of nitrate obtained directly by extraction from the earth collected in the neighbourhood is insufficient on the average to pay expenses, and it is only when the accumulation of residual earth (which after extraction is carefully stored) is sufficient in quantity or suitably matured for a second extraction, that paying quantities of saltpetre are obtained.

"If this information proves to be reliable it is obvious that a great deal can be done for the industry simply by ensuring that the time spent in maturing the store of residual earth shall be employed to the best advantage, i.e., that the optimum percentage of organic matter and moisture shall be present, that no leaching by rain takes place, and that nitrification shall not be interfered with by the addition of excessive quantities of salts in solution in the 'mother liquor' remaining after concentration, which it is the *nuniah's* practice to return to the heap of residual earth. This practice may be harmless or even valuable up to a point, after which it must tend to lower the rate of nitrification.

"The addition of wood ashes is another practice which probably might be modified with advantage after examination. The addition of organic matter will no doubt prove the most likely source of possible improvement; experiments on this point on a considerable scale are in progress."

It may be of interest in this connection to note that the normal annual exports of saltpetre from British India are 13,000 to 14,000 tons, of which 2,400 go to the United Kingdom, 2,200 to Ceylon, 4,000 to Hongkong, and 1,400 to Mauritius. The United Kingdom normally imports ten to twelve thousand tons of saltpetre, her chief sources of supply being British India, Belgium and Germany. With the supplies from Belgium and Germany cut off on the outbreak of war increasing quantities have been shipped from this country.—INDIAN TRADE JOURNAL.

MOSAIC DISEASE.

Of all the diseases which affect plants, the most puzzling and interesting is the Mosaic disease of Tobacco and other plants of the family *Solanaceæ*. This mosaic disease has been known and studied for some time with respect to its effect on Tobacco, but it has only recently been shown by MR. G. P CLINTON* that the same disease occurs in the Tomato, and that its attacks on the latter plant are on the increase. Mosaic or Calico disease of Tobacco makes its appearance in the very young leaves, and affects all the new growth. It may be recognised by the presence of light, yellowish-green irregular areas, which cause the leaf to present a mottled and wrinkled appearance. MR. CLINTON has succeeded in transferring the disease from Tobacco to Tomato plants, and has thereby been able to show that it produces similar symptoms in the latter plant and causes the disease known as chlorosis. It has also been transferred from Tobacco to Potatoes, albeit——and happily—with difficulty. A mosaic disease occurs also in Sweet Peas, and it may be that it is due to the same cause.

In spite of many and careful investigations, all attempts to discover the presence of fungus or bacterium or protozoon in the diseased tissues have

* See Report 38, Connecticut Agricultural Experimental Station, 1914.

resulted in failure, and yet the disease is infectious to the highest degree. To inoculate a healthy plant, all that is necessary is to rub crushed diseased leaves on a healthy leaf. By this means, Mr. Clinton has been able to transfer the disease from Tobacco to Tomato plants, and back again to healthy plants of Tobacco. As is but natural, these remarkable facts have given rise to much speculation as to the nature of the disease, and on this subject two opposing views are held. According to the one, the disease is due to an ultra-microscopic organism; that is, one so small as to be invisible even with the highest powers of the microscope. The fact that the virus may pass through a Berkefeld filter, which arrests bacteria, does not, in the opinion of those who hold this view, demonstrate that it is false. For if the organism be small enough it may pass through the filter. It is known, moreover, that the virus of certain human diseases—that, for example, of infantile paralysis—is also capable of passing through a Berkefeld filter.

The chief argument in favour of the "organism" theory lies in the fact that a minute quantity of virus suffices not only to infect a plant, but also to spread the disease throughout its tissues.

The alternative hypothesis holds that mosaic disease is not due to the presence and activity of a micro-organism, but to some toxic ferment (enzyme). On this view it must be supposed either that the enzyme is of almost incredible virulence, and that it spreads through the tissues, destroying them whilst it itself is undestroyed, or that it grows and increases just as a living cell may grow and increase. Here we step across the barrier which divides the little strip of the known from the dark and illimitable region of the unknown. Yet, in spite of our ignorance of the ultra-microscopic forms of life, experiments have been made which seems to indicate that the virus of mosaic disease can hardly be a living cell. For Mr. Clinton has shown that the virus may be extracted without more than partial destruction of its infective properties by means of ether, chloroform or alcohol. It may also be preserved for some time in toluol (a powerful antiseptic). In the light of these experiments, it would seem that the "non-organism" view must be accepted.

The extraordinary infectiousness of the disease deserves the attention of gardeners, for, although, so far as we know, mosaic disease is not present in Tobacco grown in this country, the facts that it may occur on the Tomato and that it appears to be on the increase in America make it important that growers should realise that the virus may be carried by the hands or by garden tools. The disease does not appear to be transmitted by the seed, but it is in the seed bed that it appears. Hence the use of sterilised soil—to be recommended on other grounds also—is likely to prove a successful means of preventing outbreaks of the disease.—The Gardeners' Chronicle.

THE BOTTLING OF FRUIT.

The best method of preserving fruit without the use of sugar, glucose, or any other added preservative, is to sterilise the fruit in bottles.

VACUUM PROCESS.

A proper sterilising apparatus including a dozen bottles, could be bought before the war for about 14*s*., but as the price of glass bottles has increased recently, a similar outfit will now be rather dearer. The bottles are constructed so that they can be hermetically sealed with either glass or tin caps, and alone formerly cost about 3*s*. 6*d*. to 4*s*. a dozen. The apparatus is convenient but not really necessary, and the process can be carried out in a fish kettle or a large, deep bowl or pan, but in this case householders are advised to stand the bottles on a false bottom, such as a piece of wood or a layer of hay, to avoid the risk of cracking the bottles.

The process of sterilising consists in filling the bottles with fruit, which must, of course, be prepared for the purpose by removing the stalks, etc., adding water to within half an inch of the rim and putting them in the steriliser, the temperature of which should be slowly raised to about 165°F. or 170°F., and kept at that point for about 10 minutes The bottles should then be securely fastened down, being screwed or capped according to the system adopted, and allowed to cool. In this way a partial vacuum is secured in the bottles, and no harmful germs from outside can obtain entry if care is taken to ensure that the bottles are airtight.

BOTTLING IN ORDINARY BOTTLES OR JARS.

If any difficulty is experienced in getting the proper types of bottles, ordinary glass jars may be used under the following conditions. If suitable corks or bungs can be got to fit the bottles, the fruit may be sterilised as described above, the cork being immediately pressed down tight and tied securely in its place. It should then be coated with a layer of paraffin wax.* If, however, the glass jar has no such stopper, it can be sealed by pouring in, until full to the rim, immediately on removal from the steriliser, a thick layer of melted fat, or of a mixture made of $8\frac{1}{2}$ parts of vaseline and $1\frac{1}{2}$ parts of paraffin wax previously melted by warming. The melted fat or wax remains on the surface of the water in the bottle and on cooling solidifies and forms a thick seal. After the bottle has cooled the wax may be found to have contracted slightly in the neck; in this case it is well to pour on a further quantity of wax to fill the neck to the rim. The mouth of the jar should then be covered with parchment, such as is used to cover jam pots and be tied firmly down. The filled jars should be stored in a cool room till required for use. Where ordinary bottles or jars are used it may be desirable to heat the contents to a rather higher temperature than that used in the vacuum process. The essential point in either system is that air containing harmful germs or spores of fungi should not be allowed to reach the fruit after sterilisation So long as the seal used in the case of ordinary bottles remains perfect the fruit can be kept as successfully as in the vacuum process, but the seal may become damaged or may tend to crack owing to contraction of the wax, and germs may then obtain entry to the fruit. Bottles treated in this way should, therefore, be examined from time to time, and if imperfections in the seal are noticed they should be remedied.—JOUR. OF THE BD. OF AGRIC., LONDON.

CHARCOAL BURNING.

In countries where wood is abundant, charcoal is produced by burning conical piles of billets of wood, about 12 feet in height and from 10 to 40 feet in diameter, the wood being set on fire from the top of a central hole or chimney. The wood is felled in winter, and must be tolerably dry; it is built up with the bark outermost, the largest billets being placed in the interior of the pile; over the whole is laid a covering of turf or of charcoal dust and soil. The combustion of the wood is conducted from above downwards, and from the exterior towards the centre, so that the charcoal in a half-burnt heap forms an inverted cone. At the sides of the heap are holes for the admission of air, the number and size of which are a matter of importance. The first, or "sweating" process, lasts three or four days, during which the cover becomes moist with condensed water. The openings round the base of the pile are then covered, and a series of holes made about half

*This can be obtained from most chemists and should be melted and applied with a brush. Hard paraffin wax should be asked for. If this cannot be obtained, a wax candle may be melted and used.

way from the top of the heap; as the smoke ceases to issue from these they are closed, and other holes made below as required. The tarry products which collect towards the close of the operation are removed from the heap by means of gutters or pipes. Sometimes the base of the heap is made in the shape of a flat funnel, from which proceeds a channel for the tar and acid. When the airholes of the burning heap no longer emit smoke and flame they are carefully stopped, and the pile allowed to cool for two or three days. The charcoal is then drawn, and any pieces which may be still glowing are quenched by plunging them into water or sand. By this method 128 cubic feet of wood yield about 30 bushels of charcoal. Peat charcoal is produced by the carbonisation of peat in kilns or circular shafts of brick and stone-work. The ignition proceeds from above downwards. Animal charcoal is produced by igniting fresh and coarsely comminuted bones, which have been previously boiled to remove fat, in closed vessels of iron or earthenware. The charcoal so produced, which weighs about half as much as the bones employed, is hermetically sealed, as soon as made, in iron canisters. Animal charcoal makes a good manure.—Gardeners' Chronicle.

ASSIMILATION OF CARBON.

The fundamental chemical operation performed by the green leaf, whereby the carbon, including compounds, sugars, starch, and cellulose, are manufactured from more elementary substances (carbon dioxide and water), has been the subject of countless investigations during the past forty or fifty years. Yet, in spite of all this work, our knowledge of the process is still far from complete. We know that both sunlight and chlorophyll are essential to the process, but how chlorophyll applies the radiant solar energy to this work we do not know. Whether living protoplasm lends its cunning hand to the manufacture has not been finally established. We know that within a few minutes of sunlight falling on a leaf, starch makes its appearance therein, and in various ways it has been established fairly conclusively that this starch is not a direct product of the manufacturing process, but only a convenient form of storage or reserve carbohydrate. One important argument that starch is not the first carbohydrate formed in the green leaf is derived from the fact that the leaves of many plants contain no starch. This, for instance, is the case with many monocotyledons, such as *Allium Cepa* and *Scilla maritima*. For this, as well as for other reasons, it is generally agreed that some form of sugar is the first carbohydrate-product of assimilation.

Opinion, however, is divided as to which of the several kinds of sugar known to occur in the leaf enjoys the distinction of being in a sense the mother of all the carbohydrates of the organic world.

Many years ago, Brown and Morris, in a research which has become classical, gave reasons for concluding that this first-formed sugar is not, as might have been supposed, one of the simpler kinds, such as grape sugar, the formula of which is $C_6H_{12}O_6$; but the more complex and universally known cane sugar, or saccharose, as the chemists name it; a sugar which has the formula $C_{12}H_{22}O_{11}$. The question of the nature of the true final product of this manufacturing process is no mere academic one. Some day we may be sure that man will learn to make machinery do what the green plant alone can do at present—manufacture from the illimitable supplies of water and carbon dioxide the food materials of the world. Before that triumph over Nature is won, men of science must discover the trade secrets of the green leaf. Hence any step towards that discovery is important. The elaborate investigations published in the Journal of Agricultural Science* by

* Vol. VII., No. 3, February, 1916.

Messrs. Davis, Daish and Sawyer, appear to have settled finally the long-disputed question of the nature of the first carbohydrate synthesised by the green leaf. Their conclusion is that, as Brown and Morris held, saccharose (cane sugar) is that substance.

The evidence is particularly clear in the Potato. In that plant, from the time the tubers begin to develop, the principal sugar in the leaf is saccharose, and the amount increases each day from sunrise until early afternoon (2 p.m.). During the rest of the day and in the night, the amount decreases, owing to the passage of sugar from the leaf through the stem to the tubers.—The Gardeners' Chronicle.

TOMATO WILT.

This disease of the tomato is a bacterial blight. The attacked plants will suddenly and, after a time, leaves and stalks become discoloured and die. The disease is mostly spread by inoculation caused by the bites of insects. The organism causing the trouble is believed to be present in the soil, from which it spreads to the plants. Sour soil aggravates the evil.

The first step is to spray with a poisonous mixture and destroy those insects which move from plant to plant, thus spreading the disease. One ounce of Parisgreen in 10 gallons of Bordeaux Mixture will effect this. Carefully dig round the diseased plants, and prevent the spread of the web-like fungus which extends its meshes from plant to plant underground, boring directly into the healthy cortical cell, and thus giving entrance to the bacteria.

To prepare Bordeaux Mixture, use 6 lb. copper sulphate, 4 lb. quick lime, to be freely slaked, and 22 gallons water. Dissolve the blue stone in 10 gallons of water, make a white wash with the lime, and strain to separate the grit, and bring the milk of lime to 10 gallons. Mix these up to 22 gallons. Use only wooden or earthenware vessels. When the foliage is out, use the half-strength mixture by diluting in double the quantity of water. To make sure that the mixture is safe to use on tender foliage, insert a new nail or the blade of a penknife for at least half a minute; if copper is deposited on the steel, more lime must be added.—Queensland Agricultural Journal.

EXTRACT FROM THE ANNUAL REPORT FOR 1915 OF MR. C. DRIEBERG.

SUPERINTENDENT OF LOW-COUNTRY PRODUCTS AND SCHOOL GARDENS.

In purely native agriculture more or less normal conditions obtained, the paddy crop being an average one; but owing to the general retrenchment which resulted in an increase in the unemployed, steps had to be taken to prevent a shortage in the local food supply. The Agricultural Society provided the necessary funds for encouraging the cultivation of quick-growing food crops and in co-operation with the officers of the Department of Agriculture carried on a campaign in the villages instituting enquiries and distributing seeds of vegetable and of short-lived cereals (such as sorghum) as well as cuttings of tuberous plants (sweet potatoes, etc.) which helped appreciably to increase the output of edible products and provide against any possibility of scarcity in the villages.

LAC CULTURE.

The origin of the Ceylon Agricultural Society's work in connection with lac is to be traced to a suggestion made by Prof. Dunstan, Director of the Imperial Institute, that an attempt should be made to introduce the Indian

lac insect into Ceylon. Previous unsuccessful attempts had been made by the Government Entomologist. Mr. N. Wickremeratne, then an Agricultural Instructor, was deputed to study lac culture at the Pusa Research Institute in 1913 and on his return in October of that year the first successful trial with imported brood lac was made on *Zizyphus jujuba* trees at Maligatenne near Kandy. Since then very encouraging results have been obtained. The lac raised on Maligatenne with the co-operation of Mr. K. Bandara-Beddewela has been supplied to the Kandyan Art Association and there used for lacquering. Brood lac has also been introduced into Angurumaduwa near Tangalle at which place lacquer work is a regular industry, as well at Jaffna where *Zizyphus* trees are very common.

Since 1913 lac has been regularly cultivated on Maligatenne on *Zizyphus jujuba* and *Schleichera trijuga*.

Lacquer workers in the Central and Southern Provinces have hitherto had to depend on wild lac obtained with considerable difficulty from *Croton lacciferus* and it is hoped that the systematic cultivation of the Indian lac insect in the Island will help to revive the decaying Lacquer work industry.

GOVERNMENT STOCK GARDEN.

The nursery section is one of the striking features of the Stock Garden and there are at present nearly 5,000 seedlings in stock. The following have been established as hedges: *Malpighia coccifera*, *Casuarina equsilifolia*, *Pithecolobium dulce*, *Pisonia morindifolia*, *Bixa orellana*, *Acalypha marginata*, *Lawsonia alba*, *Citrus limetta*, *Hibiscus rosa-sinensis*, *Duranta Plumieri*, *Gliricidia maculata*, *Cariassa carandas*, *Phyllanthus nivosus*, *Triphasia aurantiola*.

Among the grafts established are Sapodilla on *Bassia longifolia*, Mangosteen on *Garcinia Xanthochymus*, Orange on Lime stock, lime on pomelo and red on white Plumeria.

SCHOOL GARDENS.

The total number of Government School Gardens at the end of the year was 287; but there are also 56 grant-in-aid schools which have to be examined for the Government grant. The majority of school gardens continue to maintain a high standard of efficiency.

The following is a list of the awards made for good work during the year:—

Rs. 20 Awards.—Hunumulla, Kumbaloluwa, Urubokka, Alawatugoda, Ankumbura, Gunnepana, Mahagama, Mediwaka, Beddewela, Hettimulla, Wakirigala, Tennepanguwa, Etambagaskada, Eppawala, Ambanpola, Awulegama, Gokarella, Makandura, Poramadulla, Wariyapola.

Rs. 15 Awards.—Keenadeniya, Paragastota, Walallawita, Bussa, Kiula, Narandeniya, Hindagala, Nugawela, Paranagama, Yatawatta, Gettiyamulla, Kehelwatta, Mawanella, Dippitigala, Ilukkumbura, Pallekanda, Soranatota, Mahaelagomuwa, Balalla, Boyagane, Buluwala, Girilla, Itanawatta, Kankaniyamulla, Mahananneriya, Nakkawatta, Wadakada, Weuda.

Rs. 10 Awards.—Ellakalla, Kirindiwela, Kumbaloluwa Girls, Halwala, Ittapana, Magedara, Katuwana, Mandaduwa, Walasmulla, Alapaladeniya, Kotapola, Panwila, Teldeniya, Leliambe, Naula, Ambepussa, Dickwella, Etampitiya, Haputale, Passara, Opanaike, Iratperiyakulam, Galediulwewa, Galkiriyagama, Kendewa, Mahadiulwewa, Mahamankadawala, Talgaswewa, Topawewa, Borawewa, Dahanekgedara, Diullegoda, Galgamuwa, Ibbagamuwa, Kuliyapitiya, Mæliya, Medagama, Narammala, Nikaweratiya, Talgaswewa, Tammennawetiya, Udawela, Wekada.

HOME GROWN FOOD SUPPLY.

If the country is to be made more self-supporting by an increase in the home supply of bread and meat, the most economical and efficient instrument for the purpose is the large farm. Large farms with capitalist tenants stand

to the small occupiers of 50 acres and under where the factory stands to the domestic industry. An increased use of machinery with a smaller but a better paid staff of labour will effect the greatest increase in the production of bread and meat at the greatest economy of cost. On the other hand, the lesser products of farming are those which are best suited to small tenants. But fruit, flowers, vegetables, poultry, eggs, and retail milk are not substitutes for bread and meat; and, if large farms are indiscriminately broken up into small holdings suitable for *la petite culture*, the national food supply is endangered. The utmost care must be exercised to maintain a due proportion, and not to sacrifice one object to the other.

If national interests or necessities imperatively demand a rapid increase in the home-grown food supply, formidable difficulties at once arise. Unless the nation is prepared to secure to farmers remunerative and stable prices, it cannot justly compel them to sacrifice what they believe to be their business interests. Yet any direct attempt to make the country more self-supporting in the immediate future seems to lead at no distant date to the State exploitation of the agricultural industry. How far this result is anticipated by, or would be acceptable to, those agriculturists who join in the demands for prompt action it is impossible to say.

INDUCEMENTS TO PLOUGH.

It is proposed to offer inducements to farmers to plough up their grass land at once, or as soon as sufficient labour is available. What form should the inducement take? An appeal to patriotism is one thing. Farmers responded loyally last year by growing more wheat on their existing arable land, but without increasing the area. A business proposition is another and a different thing, and the inducement must be not only strong, but one which will carry them over the anticipated slump in prices. Farmers know that natural protection is coming through the inevitable rise in prices. Therefore, if the inducement to immediate action is inadequate, or is saddled with unacceptable conditions, it will have little effect in increasing the area of arable cultivation.

Three forms of inducement have been suggested. One form is a duty on imported wheat, which would exclude foreign supplies so long as home prices were, for example, below 45*s.* a quarter. This means a sliding scale, with its attendant opportunities for speculation and a dearer loaf for consumers. Another form is a guarantee of a minimum price for home-grown wheat of, say, 45*s.* a quarter for a fixed period of years. This throws upon the tax-payer an uncertain burden, but leaves the consumer his cheap loaf. The third form is a bounty on each additional acre ploughed, based in the first year on the cost of the operation, say, 25*s.* to 30*s.*, and reduced to 10*s.* an acre in three succeeding years. This does not regulate the crop to be cultivated, and, except on the added area, leaves the wheat grower at the mercy of the anticipated slump in prices.

A STABLE PRICE FOR WHEAT.

At present prices the cost of producing a quarter of wheat is in the region of 40*s.* A minimum price of 45*s.*, whether secured by duty or by guarantee, would be a reasonable offer. Farmers are just now thinking of 55*s.*; but in cooler moments their ideas may become less extravagant. At this stable price, fixed for at least 10 years, an attractive inducement would be offered. If the existing tenants refused the offer landlords would be justified in replacing them by those who would accept it. But whichever form of inducement may be selected, it will not be offered without conditions. One condition will probably be that of a minimum wage. Nothing would be more unpopular with farmers, and, without discussing details, their objections are not wholly unreasonable. Assuming that those practical objections were overcome, farmers would still have to consider the question as a business matter.

The difficulty, then, is this. The stable price alone would be an inducement to plough. But the stable price, saddled with costly and onerous conditions, would probably produce little effect. It is for statesmen to decide. If the national safety demands that this country should at once be made to a substantial degree self-supporting, then heroic remedies may become necessary. In default of the acceptance of conditional inducements, the State must in that case be prepared to resort to compulsion. National necessity overrides all other considerations. But until the Government arrives at a decision on that plea, it seems a doubtful policy for the friends of agriculture to press for changes of fiscal policy which, at the present moment, are not likely to be made except on severe conditions.

The hope of agricultural progress is centred in the intensive cultivation of an extended area of arable land, and that hope cannot be realized without prices which are both remunerative and stable. Sooner or later, the change must come. It is to the nation's interest that it should be sooner rather than later. Some increase in production might, of course, be obtained on the existing arable area. The average of farming might approximate more closely to the highest standard. All farmers might recognize the golden rules observed by the best—to clean their land before it is foul, to feed it before it is hungry, to rest it before it is tired. Drainage is urgently needed on some heavy land, and many minor improvements in agricultural practice might be suggested. But, broadly speaking, it is only by increasing the area, and intensifying the cultivation, of arable land that any substantial addition can be made to the gross production of bread and meat and at the same time of dairy produce. What is meant by intensive farming is the skilful choice and liberal application of the fertilizers appropriate to different soils and varying crops. In other words, it means the adoption on the larger areas of arable farms of the costly methods already applied to such special products as hops, potatoes, or vegetables—methods which low and uncertain prices render either too unremunerative or too hazardous in other forms of agricultural produce.

WHAT SCIENCE MAY DO.

Science may possibly provide a way of escape from the dilemma. There seems to be no limit to its triumphs. If it can cheapen fertilizers, some of the results would be attained which would naturally follow higher and more stable prices. Cheapness would encourage the use of fertilizers and stimulate arable farming by reducing the cost of production. Our dependence on foreign countries for our main supplies suggests a further reason for scientific intervention. We draw our nitrogenous manures from the Chilian deposits of nitrate of soda, or from the electrically manufactured products of Notodden in Norway; our phosphates reach us from Algeria; our potash comes from the Stassfurt deposits of Germany. All these sources are interrupted or cut off by the war. It would be an inestimable boon if British science could provide alternative resources in this country, and supply them on a commercial basis. One step in this direction has already been taken. Of the two manufacturing processes of obtaining atmospheric nitrogen, the one installed at Notodden requires abundant water-power. The rival method seems about to be established in the country. Even the bigotry of Free Trade bows to the necessities of war. A brief notice in the Press states that the Ministry of Munitions is financing a Nitrogenous Products and Carbide Company for the supply of nitrate of ammonia and nitric acid. In time of peace agriculturists may possibly benefit by this official lapse into economic heresy. It is to be regretted that the same breadth of view has not established in this country the process of peat conversion, from which Germany expects so much. Not only is sulphate of ammonia a by-product, but another promised result is the reclamation of highly fertile land on which thousands of discharged soldiers and sailors might be placed in the United Kingdom.

RESTRICTION ON EXPORT

Partly in the interests of agriculture—and the action of the Government, at a time when the export trade is exceptionally valuable, should be gratefully acknowledged—restrictions have been placed on the exportation of home-produced sulphate of ammonia. But farmers require to be educated to its use, and present prices are almost prohibitive. It is, perhaps, too much to hope that, after the war, some restriction on exportation will be maintained. The same pious wish may be expressed as to basic slag, the export of which has been, for the time, similarly restricted. Now that our deposits of coprolites are nearly exhausted, it is, with the exception of bones, our only home-produced source of phosphatic manures. The supply of potash presents a still more difficult problem. Neither wood-ashes nor kelp will replace the deposits of Stassfurt. Whether a solution of the problem will be found in our own inland salt-beds, or even in the sea itself, or in some other direction, may be safely left to the investigations of our men of science.

The importance of fertilizing agencies and of knowledge of their use can scarcely be exaggerated. Only a fringe of the subject has been touched on. Artificial fertilizers have materially helped to revolutionize the agriculture of Germany, and in the development of our own agricultural industry they must necessarily play a foremost part. But Germany has not only supplied manures as cheaply and abundantly as possible. She has also provided for her agriculturists the opportunity of scientific education. For our rising generation of farmers, convenient access to a more scientific training during their school age is one of the educational needs of the day.—The Times.

THE DATE PALM IN EGYPT.

T. W. BROWN.

(*Continued from p. 359 Vol. XLVI.*)

WATERING ADULT PALMS.

The deep rooting habit of the palm enables it to dispense with surface irrigation entirely in situations where the underground water does not fall more than five to six metres below the surface of the soil. Cases are known where the palms are growing and bearing fruit under such conditions without any artificial irrigation. The maximum yield of fruit is, however, not obtained in these cases. The palms must draw their moisture from the lower strata of the soil and consequently make very little use of the richer and more fertile layers near the surface. The cost of irrigating date trees is repaid twofold, even in situations where it is not absolutely necessary for the life of the tree. Adult palms which are growing on sandy land should be watered if possible every seven days in summer, if the soil is loamy, they may be watered at intervals of twenty days.

Even on land where the subterranean water is far below the surface of the ground, the deep rooting qualities of the plant enable it to live two to three months without irrigation. This fact is important in districts where the water supply is liable to be cut off temporarily. On the other hand the land upon which palms are growing may be flooded for six to eight weeks yearly without doing any apparent injury to the trees. Adult palms should be kept fairly dry during the months of December and January. They should be watered in February before the bunches appear and no more until the month of June. Although this system is known to give the best results it is seldom followed, because ground crops are usually cultivated between the trees and irrigation regulated according to their needs and not according to the needs of the palm. The best way to irrigate is to flood the whole surface

of the ground but this requires a large quantity of water, and where it has to be pumped the system is somewhat expensive. If a ground crop is not cultivated with the palms the water should be run along channels between the rows of trees.

SOIL.

Dates can be grown profitably on any variety of soil, The chief centres of production in Egypt are situated on sandy land. This is due to the fact that the trees grow as well as, or better than, anything else, on this kind of land, but it does not necessarily imply that the tree grows better on sandy than on rich alluvial land. In fact they appear to grow most strongly on deep porous soil such as that formed by the coarser deposits of Nile silt, and which is known as *gezîra* or *tamî* land in Egypt. With regard to varieties there is no apparent difference in their soil requirements. The Samani, which is grown almost entirely on pure sand on the Rosetta and Edku Districts, thrive and bear equally well when planted on black land in other districts. The same remark applies to other varieties. To what degree date palms can support the presence of salt in the soil is not quite clear. We are indebted to Mr. Frank Hughes, Chemist to the Ministry of Agriculture, for the analysis of soil and water taken from existing date groves. One sample of soil taken at a depth of one metre below the surface quite close to a palm at Sannannia contained 0·13 per cent. of chlorides expressed as sodium chloride. In another sample the percentage was 0·22. Water taken from a hole made among the roots of the palms at the same place contained salt to the extent of 33,080 parts per million. It is to be observed that the palms growing in this district are much inferior in health and vigour to others growing on sweet land in more favoured parts. There is, however, no doubt that the date trees when once established are more resistant to salt than many other cultivated plants, but the number of off-shoots which die when first planted on salt land is always high. Where palms must be grown under these conditions, drains should if possible be made between the first and second rows, the space between the second and third rows is levelled for watering, a drain is made between the third and fourth rows, and so on.

MANURE.

No plant responds more rapidly and distinctly to the liberal application of manure than does the date palm, and the necessity of manuring the trees in some way is generally recognized by cultivators throughout the country, except perhaps in Upper Egypt. In the Rosetta and Edku districts, where the well known *Sámani* date is grown, the trees are manured one year after being planted on high land. A hole about one metre square is made on one side of the palm to near the depth of the underground water table. Pigeon manure is placed in the hole, the quantity varying from two ardebs (about eleven bushels) for a strong healthy tree to half ardeb for those which are more weakly. The palms are manured every second or third year. If they are not manured for five or six years they stop fruiting. The hole for the manure is made on a different side of the tree on each occasion. As previously stated the dates in this district are growing in pure sand. In many districts field crops are cultivated between the trees and the manure which is given to the former serves to feed the latter also. Such is the case at Kerdassa, where the soil to a considerable depth consists of loose sand. Vegetable marrows, tomatoes, etc., which are fed with pigeon manure, farmyard manure, and night soil, are grown underneath the palms. At Sannânnia, near Damietta, the land is loamy but somewhat salty. Here the palms are often given pigeon manure at the rate of one to two kêlas (one kêla=3·6 gallons) per tree, the manure being placed in a straight trench about fifty centimetres deep and not less than one metre from the base of the tree. A donkey load of farmyard manure is sometimes used instead of the pigeon manure and is either put in a trench or spread over the surface of the ground.

Kufri manure is also used in the latter manner. Another way of manuring palms is to tie a buffalo for four days to each tree. The most advanced cultivators in this district manure the trees every year. At Qorein, where large quantities of *amry* dates are grown, the plantations are situated on reclaimed desert land, and those cultivators who manure their palms use pigeon or farmyard manure. At Marg the proprietors who manure the trees apart from the ground crops, use farmyard manure, which they place in trenches around the palms. It may be concluded from the foregoing that the most effective way of applying manure is to place it in a trench near the palm. Except in special cases, however, it is more economical to hoe or plough the manure into the land as is done for ordinary field crops. Where the base of the palm is not buried, the roots are sufficiently near the surface to take up plant food from the manure mixed with the top soil. Especially is this true in places where the soil and subsoil is light and where the trees are irrigated. The loss of roots which must inevitably take place in digging a trench is avoided by manuring the whole surface. In many date growing districts it is difficult to obtain natural manures at reasonable prices. There appears to be no reason why artificial fertilizers should not be used to replace or supplement farmyard manure, but there is no record of any trials having been made in this direction. The practice of making a heap of earth around old trees is of considerable nutritive value although its primary object is to give them mechanical support.—AGRIC. JOUR. OF EGYPT.

THE DETECTION OF ADDED WATER IN MILK IN INDIA.

The detection of added water in milk depends in Europe usually on the percentage of "solids-not-fat," that is the sum of the amounts of lactose, proteids and mineral matter. The milk is that of the cow and the percentage of solids-not-fat approaches 8·5 so nearly that this is considered a standard. The English law runs "Where a sample of milk (not being milk sold as skimmed, or separated, or condensed milk), contains less than 8·5 per cent. of milk solids other than milk fat, it shall be presumed for the purposes of the Sale of Foods and Drugs Acts, 1875 to 1899, until the contrary is proved, that the milk is not genuine, by reason of the abstraction therefrom of milk solids other than milk fat, or the addition thereto of water."

In India the milk sold in towns consists not only of cows' but also of buffaloes' milk and indeed usually it is largely the latter. The percentage of solids-not fat in there is not identical, that of buffaloes' milk being generally greater. The difference is principally due to a higher percentage of proteids in buffaloes' milk. The largest series of milk analyses which have been published are those by MEGGITT & MANN from which the following average percentages are deducible:—

	No. of animals	No. of samples	Solids-not-fat %
Gir cows' milk	4 to 8	26	8·95
Sind cows' milk	4 to 12	112	9·41
Surti buffaloes' milk	6 to 18	68	10·37

These samples were the mixed milks of a number of animals in each case as shown in the statement.

The mean percentage found for the milk of the Montgomery cows at Pusa is 8·79. There is thus a wider range of percentage of solids-not-fat in Indian than in English milks, and since there is no means of ascertaining the respective proportions of buffalo and cow's milk when mixed, if dependence

is placed on the proportion of solid-not-fat as a means of detecting added water, we would have to adopt a figure which would not be too high for cows' milk alone. Such a figure would be say 8·8 and the seller of buffaloes' milk might add some 18 per cent. of water and still sell a milk containing the required percentage of solids-not-fat. A more reasonable standard would be based on the assumption that the milk sold in Indian towns is always at least one half buffaloes' milk. On this assumption the mean percentage of solids-not-fat has been calculated from the 68 buffaloes' milks, 26 Gir cows' milks and 42 of the Sind cows' milks as published by Meggitt and Mann. This mean percentage is 9·83. The probable error deduced from these 136 samples is + 0·444, and the probability is 100 : 1 that any milk found to contain less than 8·10 per cent. solids-not-fat contains added water. The variation or error + 0·444 is naturally high because of the considerable difference between the general composition of the cows' and buffaloes' milks respectively as well as because of the natural variations among the milks of the same class. Supposing such a standard as 9·83 per cent. to be adopted, it still leaves it open to the buffalo milk vendor to add some 10 to 20 per cent. of water without fear of detection.

Latterly, attention has been directed to the value of two other characteristics of milk for the detection of added water. The one is the refractive index of the milk serum, the other is the freezing point of the milk.

The former has not been used in this laboratory, but judging by published data this method would hardly detect 10 per cent. of added water.

The latter method, that which depends on the freezing point of the milk, is more dependable, and has been used rather extensively, resulting in proof that the freezing point of pure milk varies so slightly that quite small additions of water can be readily detected. Thus:—

Winter and Parmentier found ...	–0·54 to –0·57° C.
Cornalba	–0·55 to –0·56° C.
Beckmann and Jordis... ...	–0·554° C.

The Queensland Government has adopted the following standard for milk. "Milk shall be the normal, clean, and fresh secretion obtained by completely emptying the udder of the healthy cow properly fed and kept, excluding that got during fifteen days immediately before, and ten days immediately following on, parturition. It shall contain not less than eight and five-tenths per centum of milk solids-not-fat, three and three-tenths per centum of milk fat, and not less than twelve parts per centum of total solids; its freezing point shall not be higher than 0·55° C. below zero."

During the last two years opportunities have been taken of ascertaining the freezing point of genuine milks at Government dairies in India, most of the samples being those of single cows or buffaloes, and whilst I have found a considerably greater variation than most other observers, still the test remains very much more reliable for the end in view than that of the percentage of solids-not-fat.

The freezing point of milk is due to the several constituents which are soluble in water, those which are insoluble such as the fat, exercising no influence on it.

(The author then proceeds to explain the influence of water-soluble constituents, e.g., proteids, lactose, phosphate and chloride, on the freezing point.)

In determining the freezing points of the milks which have been tested in India, it was found that the individual variations were considerable, but in making this comparison it is to be recollected that the samples have been mostly those of single animals, whereas the milk sold in towns is the mixed milk of a number, in which the variation is naturally less.

The mean freezing point of the 77 samples examined excluding pasteurized and separated milk and colostrum, was –0·542° C.

The following table exhibits the percentage of added water corresponding to the freezing point of the sample.

Percentage of added water corresponding to the freezing point of the sample.

Freezing point °C.	%	Freezing point °C.	%	Freezing point °C.	%
-0·542	0·00	-0·442	17·40	-0·342	34·80
-0·537	0·87	-0·437	18·27	-0·337	35·67
-0·532	1·74	-0·432	19·14	-0·332	36·54
-0·527	2·61	-0·427	20·01	-0·327	37·41
-0·522	3·48	-0·422	20·88	-0·322	38·28
-0·517	4·35	-0·417	21·75	-0·317	39·15
-0·512	5·22	-0·412	22·62	-0·312	40·02
-0·507	6·09	-0·407	23·49	-0·307	40·89
-0·502	6·96	-0·402	24·36	-0·302	41·76
-0·497	7·83	-0·397	25·23	-0·297	42·63
-0·492	8·70	-0·392	26·10	-0·292	43·50
-0·487	9·57	-0·387	26·97	-0·287	44·37
-0·482	10·44	-0·382	27·84	-0·282	45·24
-0·477	11·31	-0·377	28·71	-0·277	46·11
-0·472	12·18	-0·372	29·58	-0·272	46·98
-0·467	13·05	-0·367	30·45	-0·267	47·85
-0·462	13·92	-0·362	31·32	-0·262	48·72
-0·457	14·79	-0·357	32·19	-0·257	49·59
-0·452	15·66	-0·352	33·06	-0·252	50·46
-0·447	16·53	-0·347	33·93	-0·247	51·33

—Bulletin No. 57, Agric. Res. Inst., Pusa.

AGRICULTURE IN THE PHILIPPINES.

RICE GROWING.

There are a number of different factors which determine in a large measure the condition of the rice industry in these Islands, the most important of which are water supply, work animals and labour, and variety and quality of seed.

At the present time a large part of our rice is grown without artificial irrigation, and until such times as irrigation works are more generally developed the quantity of lowland rice produced annually in the Philippines will depend in a considerable degree on whether or not weather conditions are favourable.

During the past five years the number of carabaos available for work in the rice fields has increased each year. During the same period, and particularly during the last two years, the use of selected seed of the best varieties of rice has been much more general than formerly. That these factors are having an appreciable effect on the status of the rice industry is clearly shown both by our rice imports and by production.

In 1905 we imported P 13,491,950 worth of rice. From 1906 to 1911 the value of the importations of rice ranged each year from 8 to 13 million pesos. The total number of rice imports for the two years of 1913 and 1914 was P 12,881,478. In 1912, however, and again in 1915, on account of crop failures due to drought, there was a large increase in rice importation.

In order to show what has been the normal increase in production of rice, it is necessary to select two years in which weather conditions were fairly normal. In 1906 we produced 17,394,016 cavans* of palay, and in 1913, 24,498,858 cavans, an increase of 7,104,842 cavans, or 40 per cent., in a period of five years. During this same period the average production per hectare increased from 15·05 cavans per hectare to 21·47 cavans per hectare, an increase of 42 per cent.

The steady reduction in the annual loss of work animals from rinderpest, and the steady increase in the number of rice growers who are planting selected seed are improving the condition of the rice industry each year. We cannot be assured, however, of an annual rice crop that will be sufficient to meet the local demand until our irrigation works are more fully developed than they are at the present time.

COCONUT PLANTING.

The rapid development of our coconut industry, which was more than three hundred per cent. within a period of eight years, is most clearly shown by the value of coconut products (copra, copra cake, and coconut oil), exported. The value of coconut products exported in 1905 was P 6,797,906, whereas in 1912 it was P 28,367,012. Owing to the destructive typhoons, followed by the outbreak of the European war, both production and prices of copra were considerably reduced in 1913 and 1914. The value of coconut products exported in 1912 was P 21,432,530, an increase, under favourable conditions, of P 14,634,624 over 1905.

There is a large increase each year in the area devoted to coconuts, reports showing that more than four million trees were planted during the year of 1914.

The grave danger to this industry from coconut budrot has been largely eliminated by the system of Government inspection of coconut groves in infected districts. Under this system 1,335,412 trees were inspected, and 568 infected trees were destroyed during 1915.

The increasing production of coconut oil in this country, and the attention that is now being given to improved methods of drying copra will both serve to stimulate this industry.

Considering the fact that but very little foreign capital has been invested in coconut planting, the development of our coconut industry during the past ten years can hardly be considered other than satisfactory, and there is every indication that there will be even more rapid development during the next decade.

TOBACCO PLANTING.

The exports of Philippine tobacco and tobacco products in 1905 were valued at P 4,563,406; in 1912, P 10,726,764; and in 1914, P 8,355,064. The production of tobacco in 1914 was seriously curtailed by unfavourable weather conditions, but even under these conditions, the exports show nearly 100 per cent. increase over the exports of 1905.

The tobacco industry, while showing a reasonable degree of development, is not in a satisfactory condition, and the situation is one that is extremely difficult to regulate. The majority of the tobacco producers are small planters who cultivate not more than 1 or 2 hectares of land. They are without capital and have become accustomed, through long practice, to receiving advancements on their crops from tobacco buyers and middlemen. The tobacco crop is sold in large part according to quantity without respect to quality, and under these conditions, there is but little inducement for the growers to improve their crop.

*One cavan equals 48 kilos, or 75 liters.

During the past two years selected and cleaned tobacco seed has been distributed throughout the principal tobacco-growing districts, and the planters have been instructed regarding the preparation of seed beds, the care of the crop, and the handling of the product. This work has resulted in improvement, but until there is a radical change in the economic situation in the tobacco districts this important industry will not develop as rapidly as it otherwise would.—PHILIPPINE AGRIC. JOUR.

PLANTAIN STALKS AND SKINS.

The Banana has long been known to be a greedy feeder on potash.

In a lecture before the Yorkshire Section of the Society of Chemical Industry, ELLIS drew attention to the high potash content of the stalk and skin of the banana. Juice squeezed out of the stalk by means of a meat press was found to be alkaline and contained 0·7 % of potash.

The following are the analyses:—

	Ash of Stalk.
Silica	9·61 %
Iron Oxide	0·16 ,,
Alumina	3·49 ,,
Lime	1·69 ,,
Magnesia	1·68 ,,
Potash	45·90 ,,
Soda	Trace
Sulphuric acid	2·1 ,,
Carbonic acid	31·11 ,,
Chlorine	1·52 ,,
Phosphoric acid	2·74 ,,

Probably West Indian Variety of Banana.

	Stalk.	Skin.
Moisture in original ...	91·6 % 92·7 % ...	88·2 %
Dried matter in original ...	8·4 ,, 7·3 ,, ...	11·8 ..
Ash in original ...	2·4 ,, 1·5 ,, ...	1·77 ,,
Potash in original ...	1·14 ,, 0·9 ,, ...	1·05 ,,
Ash in dried matter ...	29·9 ,, 20·5 ,, ...	15·00 ..
Potash in dried matter ...	13·73 ,, 12·35 ,, ...	9·03 ..
Potash in ash ...	45·9 ,, 59·1 ,, ...	57·13 ..

Ceylon Plantains (Colombo Analyses.)

Stalk.		Skin.
87·6 %	...	81·1 %
12·4 ,,	...	18·9 ,,
2·27 ,,	...	2·34 ,,
0·99 ,,	...	1·09 ,,
18·30 ..	...	12·30 ..
7·98 ,,	...	5·76 ,,
43·60 ,,	...	46·50 ,,

It is to be noted that the Ceylon Plantain contains less ash and potash than the Western banana.

About 9,000,000 bunches of bananas are imported into the British Islands annually representing about 1,500 tons potash; this is distributed all over the Islands and is difficult to recover economically.

In Colombo large quantities of plantains come into the cities from the country, denuding the country of potash and passing to the towns, where it is not required and is wasted. The same thing goes on all over the world, one country is denuded at the expense of another. The only way to balance economically the denudation of fertilising material is by application of concentrated fertilisers to cultivated lands.

CASHEW NUTS.

Among the edible nuts produced in the British Empire, the cashew nut is worthy of note as one that has recently been attracting increasing attention in this country. It is the fruit of an evergreen tree, *Anacardium occidentale*, Linn. (Nat. Ord. Anacardiaceæ), which is native to South and Central America and the West Indies, and is now found more or less plentifully in the tropics generally, especially in India, Indo-China, the Malay Peninsula, the Philippine Islands, West and East Africa, and Madagascar. It exists in small numbers in Australia.

The tree, in the wild state, is of somewhat irregular and spreading habit, but under cultivation its growth is more upright; it attains a height varying in different countries from about 16 to 30 or 40 feet. It seems to grow best on a sandy soil; it withstands drought well, though its productiveness may sometimes be increased by suitable irrigation. It prefers low altitudes, but in the immediate neighbourhood of the sea its form tends to be stunted, and it does not generally flourish so well if it is exposed to excessive wind. In India its habitat is mainly in the coastal forests, especially in the Goa district.

It is quick growing, and may bear fruit as early as its third or fourth year, though generally not in great quantity till its eighth or tenth year. The flowers are small, rose-coloured, and aromatic. In Madagascar flowering begins about February, and the fruits are mature about June; in other countries flowering may commence in December, and the fruits ripen as early as April or May. In Brazil and in Portuguese East Africa, the tree is reported to be in fruit about January. The tree is usually grown from seed, but can also be propagated by grafting or layering.

The fruit is kidney-shaped, greenish at first, dull grey when ripe, and about 1 to 1¼ in. long. The stalk, immediately above the fruit, undergoes a remarkable swelling until it forms a fleshy, pear-shaped receptacle, considerably larger than the fruit itself; this receptacle, known as the "cashew apple," and sometimes incorrectly as the "fruit," is red, yellow, or sometimes white, according to the variety of the tree.

The pericarp, or "shell," of the nut is externally hard and leathery; internally it is cellular, and contains a dark brownish, acrid, oily juice, which has a powerfully vesicating action on the skin. The kernel, which constitutes about 30 per cent. of the nut, is covered with a thin yellowish or greenish grey skin, the flesh is a clear white.

The kernels have a bland taste; they are eaten in the countries where the tree grows, and are esteemed as a dessert nut in Europe. They are used, after roasting, as a constituent of nut chocolate, and have other applications, similar to those of the almond, in confectionery.

In the following table the composition of the kernels, recorded in the Phil. Journ. Sci. (1913), 8, A, 66), is compared with that of sweet almonds:—

	Cashew-nut kernels Per cent.	Sweet almonds Per cent
Water	16·01	6·9
Proteins	18·00	24·0
Fat	57·38	54·0
Carbohydrates, etc.	5·28	10·0
Fibre	0·91	3·0
Ash	2·42	3·0
Food units	194	205
Nutrient ratio	1:7·63	1:5·59

The kernel oil is of non-drying character; it is pale yellow in colour, and has a bland taste, which is considered equal to that of almond oil. Determinations of its chemical and physical constants by different observers are not in very good agreement, but the figures recorded mostly lie between the limits shown in the following table, which also includes the constants of almond oil:

		Cashew-nut oil.	Almond oil.
Specific gravity	...	0·911-0·916	0·917-0·919
Saponification value	...	182-195	189-195
Iodine value *per cent.*	...	77-85	93-101·2

There is a good market for cashew kernels in the United Kingdom, as well as on the Continent; they are shipped in considerable quantities from Portuguese East Africa to European ports; shipments received in London are, however, mainly from Bombay.

The kernels are always shipped without the shells, the nature of the pericarp oil rendering the shells highly objectionable. Decortication is effected by slightly roasting the nuts, which has the effect of causing the shells to split open, rendering their removal less difficult. The roasting operation has to be conducted with care, as the pericarp oil gives off a vapour which is very injurious to the face and eyes. The roasting has the effect of making the kernels keep better, but it converts the white colour of the flesh into a pale yellowish-brown.

The kernels generally come on the European markets in cases containing 2 cwt., or 100 kilograms. The price fluctuates considerably, depending upon the supply of almonds; when these are scarce, as at present, the demand for cashew kernels increases, and the price rises in consequence. Early in the present year the Indian kernels were quoted in the United Kingdom at 55*s.* to 65*s.* per cwt. Blanched or "peeled" kernels (i.e. kernels with the skins removed) are also shipped from India to London in small quantities, and command a higher price; they were quoted at about 72*s.* 6*d.* per cwt. at the beginning of the present year.

The cashew nut has not, up to the present, been used as a source of oil, the price obtainable for the kernels for confectionery and other edible purposes being prohibitive to the oil-mills.

In addition to the kernel the tree yields other products which are utilised locally. The pericarp juice is used in India by natives for medicinal purposes, and for preserving the floors of houses, carved wood, and books, from the attacks of white ants; and the Andaman Islanders use it for preserving fishing nets. Its chief chemical constituents are cardole and anacardic acid, which are present to the extent of about 10 per cent. and 90 per cent. respectively in the ether-extract; it is to the former, that the peculiar irritant properties of the juice are due.

The cashew "apple" is succulent, and is eaten as a fruit, either raw or cooked, in the countries where it occurs; it can also be made into a preserve. In Brazil, Portuguese East Africa, and some other countries, a wine is prepared from the juice by fermentation, and a spirit is obtained from the wine by distillation. Both the wine and the "apple" itself are considered to have antiscorbutic properties.

The bark of the tree exudes a gum, which is only partially soluble in water; it is said to be used in book-binding both in India and in South America and to be effective in keeping away destructive insects. The bark also contains a milky sap, which turns black on exposure to air and is used in countries where the tree grows as an indelible ink for marking linen. The sap is also stated to be used as a varnish, and, like the pericarp juice, for preserving fishing nets.

The wood of the tree is fairly hard and of a reddish brown colour, and has a limited use as a timber; according to R. S. Troup in his *Indian Woods and their Uses (Indian Forest Memoirs: Economic Products Series*, 1909, I, 76), it weighs 35 lb. per cubic foot, and is used in India for boat building, as well as for making packing cases.—Imp. Inst. Bull.

THE AVOCADO IN CALIFORNIA.

IRA J. CONDIT.

Avocados are easily grown from seed, but the resulting plants are exceedingly variable in growth, age of bearing, and productiveness. Some trees never blossom, others blossom but set very little if any fruit, while a few produce very good fruit. Budded trees are reproductions of the tree from which the bud was taken and only budded trees of known varieties should be planted for commercial purposes. Seedlings grown from the small, thin-skinned Mexican fruits are preferred as stock for budding on account of their greater hardiness, but there are very little if any data at present to show the superiority of one stock over another so far as the resulting tree is concerned.

PRODUCING SEEDLINGS.

Seeds are commonly planted with the pointed end up, in four or five-inch pots containing sandy soil, about one-fourth of the seed being left exposed. Germination often takes place in one month if bottom heat is used; in a lath house or in the open three or four months are required for germination. In some nurseries the seeds are germinated in seed beds and then placed for a short time in four-inch pots. Seedlings should not be left in small pots for any great length of time. If the root system once becomes pot-bound or establishes a circular growth of roots, it is very difficult to get young trees to thrive when planted out. When the seedlings are from six to eight inches high they are transplanted to nursery rows, being placed about sixteen inches apart in the row. The seedlings should be ready to bud by the following October or November, the buds remaining dormant until early spring.

METHODS OF BUDDING.

The method of budding is very similar to that used with citrus trees, a large shield bud being preferred. The degree of success in budding depends upon the condition of the stock, the selection of good buds, the skill of the operator, and the subsequent treatment of the plants. The following method of budding has been most successful. Select young wood of the current season's growth, cut the bud from one to one and one-half inches long, insert it into a T-shaped incision in the bark of the stock whenever the sap is flowing freely, and bind firmly with waxed tape. At the end of two weeks, examine the work and loosen the tape if it is beginning to bind the stock too tightly. Remove the tape entirely at the end of six weeks, at which time the bud should be firmly united with the stock, The bud is usually forced into growth by gradually cutting back, first, the side branches and later, the main stem of the stock, the stub of which should not be cut back to the bud until the lower leaves of the new shoot have become quite mature. Budded trees are allowed to grow for one year in the nursery row before transplanting.

TRANSPLANTING FROM NURSERY.

The transplanting of balled trees from nursery rows is best done from January to March, and it is advisable to hold the trees in a lath house for a couple of weeks before planting. As a result of early planting, the trees will become established and the new growth become more or less mature before the heat of summer. Trees in orchard form should be spaced at least twenty-five feet apart. Young trees require little pruning except an occasional picking back of vigorous shoots to induce a more symmetrical growth.

GENERAL CARE OF TREES.

Budded trees are usually more or less dwarfed and come into bearing early as a rule, although there is considerable variation among the different varieties in this respect. Budded trees should begin to bear profitably the fourth or fifth year in the orchard; some will begin fruiting even in the nursery row. The avocado tree should be planted in soil which has considerable depth, contains an abundance of plant-food, and is well drained. For ease of cultivation and irrigation, a sandy loam is preferable, but the tree grows just as well, if not better, on a rather heavy soil with plenty of humus. Very little if any fertilizer should be necessary until the trees come into bearing; a mulch of straw or coarse manure may be placed around the tree to conserve moisture, but care should be taken to keep the latter from direct contact with the trunk or injury from heating will occur. Water in abundance should be provided during the first season or two in order to keep the tree in active growth, but the amount should be reduced in the late fall, as previously stated, to induce the tree to stop growth and mature its new wood in preparation for winter. However, when very hot days occur in late summer or fall, water should always be given, if only a bucketful at a time to each young tree. Avocados require about the same amount of irrigation water as lemon trees.

It is often desirable to top-work large seedlings or trees of one variety to another. This has been successfully accomplished by budding into new wood forced out for the purpose. The trees are cut back severely in the spring and the ends of the stubs are covered with heavy grafting wax or asphaltum paint to prevent decay. Only three or four of the new shoots should be left, and when these have reached a diameter of three-fourths of an inch they may be budded in the same manner as seedlings. The shoots from the buds grow rapidly and often begin to bear in two years.

PRODUCTION AND MARKETING.

Avocado trees are in many cases remarkably prolific. Individual trees of the thin-skinned Mexican type in Los Angeles County have produced annually as many as 5,000 small fruits with thin flesh and rather large seed. Such fruits are at present valuable for their seeds, on account of the scarcity of root stocks for budding. Many trees fifteen to twenty years old, both of the thin-skinned and hard-shelled types, have produced over 1,000 fruits each in one season, while a few have produced from 2,000 to 2,500. It is doubtful if such large yields can be obtained from orchard trees season after season, since budded trees do not usually grow as large as seedlings. A yearly average of 500 marketable fruits per tree from ten to fifteen-year-old trees planted twenty-five feet apart may be considered a fair yield. Some varieties with small-sized fruit may produce more.

The thin-skinned avocados bloom in the late winter and early spring, the fruit maturing from August to December. The hard-shelled varieties thus far grown in California bloom early in spring and usually require more than a year to mature. The fruit should be picked when mature and ripened off the tree, the length of time the fruit will keep varying with the different varieties but depending largely upon the degree of ripeness when it is picked. If the fruit is kept too long, on retail fruit stands, for example, the oil in the flesh becomes rancid, rendering the fruit unfit for consumption. Experiments with cold storage for avocados show that the fruit can be held at a temperature ranging from 32° to 35° F. for a period of at least two months.

Avocados grown in California and shipped to Eastern or even to Middle Western markets will have to compete more or less with fruit from Florida and the West Indies, especially in the fall of the year. Whether this competition can be met with avocados as successfully as it is being met with citrus fruits remains to be seen. Even should it be found impracticable to pack

and ship thin-skined fruits to Eastern markets and have them arrive in condition to sell in competition with hard-shelled fruits from Florida, such fruit should be in demand in the local markets for some years to come.

Estimate of profits to be derived from an avocado orchard should not be based on the performances of large seedling trees, nor on the prices received for fruit in the past. The present price of from $4 to $8 a dozen may not long be maintained when orchards now planted come into bearing and the fruit becomes more common, although high prices will probably be received for some years to come. In the United States the avocado is a comparatively new and little known fruit and experience in San Francisco has shown that it is easy to overstock that market.

VARIETIES.

Harman.—Purplish green, averaging about one-half pound in weight, with a tendency to crack around the apex when mature; seed usually loose in the cavity; tree hardy, prolific; one of the best of its type.

Northrup.—Almost black, of medium size and good quality: has two crops a year, a large fall crop and a small spring crop.

Carton.—Very dark purple, pear-shaped, averaging about 12 ounces in weight; surface smooth, not glossy; quality good.

Taft.—Pear-shaped, of over one pound weight, and of extra good quality; budded trees have not shown a tendency to bear early; the original tree bears regularly and is becoming more productive as it grows older; tree ornamental; one of the hardiest of its type; a leading commercial variety.

Challenge.—Very prolific, bearing round fruits averaging about one pound in weight; a very promising commercial variety.

Lyon.—Large, pear-shaped, of good quality; tree prolific and precocious.

Meserve.—Dark green, round, of good size and quality; a promising commercial variety.

Blakeman.—Green, pear-shaped, medium to large, of about one pound weight, of extra good quality; a promising commercial variety.

Murietta.—A good round-fruited variety which matures in the spring; a desirable type and of extra good quality; almost impossible to get buds to develop into good orchard trees.

Colorado—(commonly known as Purple Murietta).—Purplish-black, rather large; weight about one pound; flavour and quality good.

Sharpless.—Large, pear-shaped averaging over one pound in weight; seed very small in proportion to amount of flesh; a promising variety.—Bull. No. 254 Agric. Expt. Stn. Berkeley, California.

MENDELISM.

IMPROVEMENT OF CROPS.

MRS. HOWARD, M.A.

Second Imperial Economic Botanist, Pusa.

Among modern researches in biological science, the one which has perhaps become most widely known to the general public has been the discovery or rather re-discovery of what is known as Mendel's law. The re-statement of this principle has drawn attention to the great possibilities of scientific breeding, and has led to an immense amount of work and discussion. A new vocabulary has grown up, and an almost unwieldy mass of literature has accumulated. Great hopes have been entertained, not only of rapidly improving the staple crops and farm animals, but also of elevating the human race. The question of eugenics, although it has attracted some attention in England, seems to have fired the popular imagination in the United States, where,

certain of the semi-popular scientific journals devote much space to the discussion of such problems. Some years have now elapsed since Mendelism first came into prominence, and it may be of interest to see how far the early anticipations have been realised in what is, after all, the simplest and the most promising domain—the improvement of crops. Before the discovery of the principles underlying Mendelism, very little was known about hybridisation. It is true that much patient work had been carried out, but no definite principles, applicable to economic investigations, had been discovered. The results consisted mainly of records of individual experiences and were empirical and often contradictory. It was generally supposed that blending of the parental characters occurred in the offspring, and theories with regard to the proportion of the characters in such blending in subsequent generations were propounded. It was, however, impossible for an investigator to predict what would be the result of crossing any two forms or to indicate which individuals of the resultant progeny would breed true, that is, maintain their characters during succeeding generations. The chief merit of the modern investigations based on Mendel's work lies in the partial removal of this element of chance. In the 19th century, an abbot of the monastery of Brunn, Gregor Mendel, was able to deduce from his experiments on the hybridisation of peas, the principle now known as Mendel's law. The paper dealing with this investigation was, however, buried in an obscure journal, and the importance of the results obtained was not realised by scientific workers at the time. At the beginning of this century, Tschermak Correns and De Vries rediscovered the principle and restated it. Much opposition was aroused at first, but the researches of Bateson and his school and of workers all over the world have served to establish the truth of the main principles in the minds of a large proportion of scientific workers.

MENDEL'S LAW.

Briefly stated, Mendel's law enunciates that on hybridising two varieties the various characters of each parent are transmitted as independent units, that such characters remain unchanged in transmission and are present in individuals of the second and subsequent generations to the same degree as they occur in the parents. The proportions of individuals in the second generation which bear the unchanged parental characters is definite, and can be calculated by a simple mathematical process. The plants of the first generation of a cross between two varieties, which differ in a single character, are all alike and are generally intermediate between the two parents. In the second generation, three classes of plants are present, some identical with the one parent, some like the first generation and some like the other parent. The number of plants in these three classes will be in the ratio 1 : 2 : 1. Thus in a cross between two varieties of wheat one with red grain and one with white grain, one-fourth of the plants in the second generation will be red-grained, one-fourth white-grained and one-half will possess light red-grain. The latter will give rise to mixed offspring in subsequent generations, while the white and red-grained plants will breed true. If the parents differ in more than one character, these characters will be transmitted independently of one another, and will be recombined in every possible manner in the second generation. The greater the number of characters in which the parents differ, the smaller will be the proportion of individuals resembling the parents in the second generation. For instance, in the second generation of a cross between a wheat with large red grain and a wheat with small white grain one-sixteenth of the progeny will possess large red grain, one-sixteenth will possess large white grains, one-sixteenth small red grains and one-sixteenth small white grains. All these will in future give progeny similar to themselves. There will be twelve classes of intermediates, none of which will breed true. With three characters the proportion becomes one in 64, with four characters, one in 256 and so on.

It is easy to see why Mendelism raised such great hopes. If the good characters of a variety, instead of being lost by hybridisation in a blending process, emerge unchanged in the second year and can be maintained unchanged then it should be quite simple to transfer any desirable character from one variety to another. Many varieties only require improvement in a few particulars. A wheat may give a good outturn of high quality grain, but may in certain years fall a victim to rust. It should be an easy matter by crossing with another variety which possesses rust-resistance to render the first variety immune. Anyone who has seen a rust epidemic in one of the wheat tracts of India will realise what this would mean to the cultivator. Similarly if the indigenous cottons could be improved in staple, the result would mean crores of rupees to India. Most of the desirable characters exist in some individual or other, and it should be possible rapidly to build up by continued hybridisation the perfect variety of each crop. It must, however, be confessed that the results hitherto achieved have fallen below expectation, and the number of cases in which direct economic benefit has been derived from the application of Mendel's law are few. Much disappointment was experienced at first, but recent research has brought to light the underlying difficulties, and a truer conception now exists as to the degree of help which this principle can give in economic work. Mendelian principles assure us that any characters contained in the parents from which the cross is made will emerge unchanged in their descendants, and that all possible combinations of the individual characters of the two parents will occur. Nothing which is put into the cross will be lost. If the observer can pick out in the second generation, either by eye or by any form of measurement, the required plants, his object is accomplished. The successful application to economic purposes of this principle depends, however, on the power of the worker to distinguish among the progeny those individuals which possess the desired characters. It is here that the first difficulty lies. Even in the simple example given above, although it is easy to distinguish the plants with white grain it is impossible to separate these with red grain from those with light red grain.

The difficulty has been enhanced by the discovery that most of the characters of a plant are not simple but complex. They are not the unit characters of Mendel's law, but represent groups of such characters or factors as they are termed. For instance, the ginning percentage of cotton depends on several factors such as the weight and density of the fibres and the volume of the seed. If it is remembered that when the parents differ in three factors, the number of classes in the second generation is sixty-four, it will be readily understood that to the eye these must form a series which it is impossible to resolve into components. As in practice the parent varieties generally differ in several characters the number of factors involved may be very large, and the second generation may contain an enormous range of forms. In addition, most of the desirable economic characters are of a somewhat indeterminate nature. The parents' varieties are not sharply differentiated from one another, but differ in degree only. Thus, if an improvement in the flavour of a variety of tobacco is desired, both parents will possess flavour, but in one it will be better than in the other. A similar case is rust resistance or quality in wheat. No criterion exists for such characters except the judgment of the observer. A second difficulty also depends on the number of factors involved. With an increase in the number of the factors in which the parents differ, the proportion of those individuals which possess the desired characteristics diminishes. If five factors are involved there will be only one individual in 1,024 which satisfies the requirements. Thus with a large number of factors the number of plants to be grown and examined in the second generation becomes impracticable. Time in which to make the observations and space in which to grow the plants are both limited.

CONDITIONS OF RESEARCH.

All plant breeding work must be carried out on land which is absolutely uniform, for it is impossible to select plants on their merits if they have been unequally influenced by their environments. Absolute uniformity in land is difficult to attain, and even in the best equipped experiment stations the area at the disposal of the observer is limited. Most of the observations have to be made during the growing period of the plant, and they should be carried out by the same observer on all the plants at the same stage of their growing period. Moreover, to obtain a uniform stand of plants all the sowing or transplanting must be done during a very short time. Thus, even with the greatest zeal on the part of the observer, time and space impose very definite limits. The investigator has to content himself with a limited second generation in which the type he requires may, or may not, be directly represented. The remedy for both these difficulties is the same. The investigator selects from the plants of the second generation a large number of individuals which, from previous experience and a knowledge of the laws of inheritance, he believes to be the most likely to give him what he requires. These individuals when grown in the following year will differ in their behaviour, some will show undesirable characters and have to be discarded, the others will approximate more or less to the desired ideal. Among the latter, selection is repeated, and this process is continued during succeeding years until one of the selected plants exhibits all the desirable characters and maintains these on propagation. It is in these repeated selections that the insight of the successful breeder is necessary. It is not an easy matter to choose out of the bewildering mass of forms, which constitutes the second generation of the cross, those individuals which will give rise to the required type. Some help is given by a knowledge of such laws of inheritance as have been worked out for the particular crop in question but, generally speaking, these have only been investigated in a few cases and mostly with regard to external characters such as colour which are economically least important. Questions of quality, immunity to disease and size of organs have hardly been touched. In the future, further investigation will doubtless lead to a better knowledge of the laws governing the inheritance of such characters, but for the present the economic worker is dependent very largely on his own experience and insight. Should he fail in the second generation to retain the right plants his whole labour will have been wasted. On the other hand, if he tries to secure his object by keeping a large number of plants the mass of material will make detailed investigations impossible, and in the difficulty of coping with the enormous number of plants the valuable ones may be passed over. The successful investigator must steer between the Scylla of throwing away too much and the Charybdis of being overwhelmed by his material.

Other minor complications, such as coupling (that is, two characters which cannot be inherited separately), latent characters (i.e., characters which are potentially present), and characters which are mutually repulsive and cannot exist in the same individual, it is not proposed to discuss. Enough has been said to show that the later stages in the production of a new economic type are both time-consuming and complicated, and to explain why improved varieties of crops are not produced as rapidly and automatically as the preliminary experiments on MENDEL'S law led the public to expect. The application of the principles of Mendelism can shorten the work of improvement and render it more certain than in the old days, but it cannot accomplish the whole, and for the final stages recourse must still be had to the older methods of selection. Mendelism can guide us for a certain distance on the way, but it cannot, at present, by itself take us to the goal.—MADRAS MAIL.

THE CORN COB AS A SOURCE OF POTASH.

According to the Queensland Agricultural Journal the question of utilising the corn cob as well as the corn for stock feed is advocated by well known authorities, such as Professor E. W. Stewart.

The cob has been looked upon as so much waste but the experience of American farmers has been that it has a considerable value for stock feeding if ground into meal.

Mr. Brunnich of the Queensland Department of Agriculture has shown by chemical analysis that the corn cob contains ·6 to 1·1 per cent. albuminoids, 41·7 to 43·2 per cent. digestive carbohydrates, and ·2 to ·4 per cent. fat.

As regards potash we quote: It is said that while a ton of ordinary wood when incinerated only gives 100 lb. potash, 32 lb. phosphoric acid and 640 lb. lime, and burnt saw-dust yields 70 lb. potash, 160 lb. phosphoric acid and 680 lb. lime, a ton of corn-cobs reduced to ash gives 500 lb. potash, 90 lb. phosphoric acid and 140 lb. lime.

THE GERMINATION OF SEEDS.

Much work has been done and much has been written on the subject of the germination of seeds. Indeed, so long as gardening exists the capriciousness of seed germination will continue to prove a source of vexation to the gardener and of pleasure to the person with a taste for experimentation. The gardener of the old school will doubtless continue to carry old melon seed in his waistcoat pocket in the sure and certain hope that the moderate amount of warmth which they receive will provoke the seeds in due course to sprout and grow. The newer school will seek in warm water and in various chemicals, such as hydrogen peroxide, iodine, and the like, effective agents for overcoming refractoriness of germination. Recent investigations carried out by Demoussy* introduce a new factor into this old problem. Demoussy finds that seeds of Cress seven years old failed to germinate when kept moistened with distilled water, but not submerged and maintained in a favourable temperature (27°C. = 80°F.). But if the old Cress seed is treated with a dilute solution of hydrogen peroxide (0·6 volume) 30 per cent. of the seed germinated in ten days. With a weaker solution of hydrogen peroxide (0·25 volume) the germination was even higher, and reached 40 per cent.

The use of hydrogen peroxide for the purpose of awakening seeds into growth is, of course, well known; but so far as we are aware the discovery of the superior potency of the weaker over the stronger solution is new. Yet more interesting is the observation of Demoussy that the old seed behaved very differently when kept in water at a lower temperature. Thus after steeping in water at 14°C. (75°F.) 25 per cent. of seven year old cress seed germinated in 15 days, and 45 per cent. in hydrogen peroxide of 0·25 vols. In order to follow the interpretation which the author gives of these results it must be stated that hydrogen peroxide is a substance which parts readily with some of its oxygen, and the oxygen which it gives up is made use of by the seed for purposes of germination and growth.

Demoussy holds that a seed contains not only the miniature plant, but also a mass of micro-organisms, which compete with the embryo for oxygen. At the lower temperature the micro-organisms are less lively, their competition for oxygen is less effective, and such seeds as retain a certain measure of vitality are able to seize hold of the oxygen dissolved in water or liberated

* E. Demoussy (*Comptes rend.* 1916, 162, 435). Abstracted in Pharm. Journal, April 22, 1916.

from the hydrogen peroxide, and hence to start into growth. At the higher temperature, on the contrary, the micro-organisms become active and avid of oxygen, and so the poor seed has none. Two questions of practical importance arise out of these observations. In the first place, is it possible to keep down the growth and increase of the micro-organisms which live in the seed coats? This might be done perhaps if seeds were transferred to cold storage immediately after harvesting.

A second and more practical question is this: Is any method of partial sterilisation possible for seeds? For example, would it be possible by subjecting moistened seeds to a fairly high temperature to kill the micro-organisms without destroying the embryos? There is evidently room here for a promising piece of research, for, as is well known, some seeds lose their powers of germination very rapidly indeed. Such a research could not fail to throw light on the nature of the micro-flora of seeds—a subject of great importance, and one on which next to nothing is known.—Gardeners' Chronicle.

SCHOOL GARDENING IN IRELAND.

Within recent years great interest has been taken both at home and abroad in the subject of School Gardening. In England and Wales, where school gardening has been practised for a number of years, there has been a considerable increase in the number of school gardens, and there are now some thousands of schools in which the subject is taught. In Scotland, too, there has been a rapid growth of the number of school gardens within the last decade.

In Ireland the subject is a comparatively new one, and though there were a few schools which had school gardens in connection with the older agricultural and horticultural schemes, the general commencement of this subject dates from 1910 when the Department's present scheme of Rural Science and School Gardening was introduced. At the present time there are 150 schools in which the subject is taught (by teachers who have been specially trained under the Department's Programme).

The subject has also been taken up in Australia, New Zealand, Ceylon, Canada, and other parts of the British Empire, as well as in other parts of the globe, more particularly the United States of America—where magnificent developments have taken place—and over the major portion of Europe.

Before considering further the methods adopted in Ireland it might be well if some of the reasons, set forth from time to time, for adopting the subject in the public elementary and other schools were stated. The objects are first and foremost educational, and aim at improving the general education of the child, rather than in adding another subject to the curriculum (already crowded) for the child to learn. It is rather as a means to an end than as a subject, that, it is introduced, although much might be said for it as a subject pure and simple. It is not the intention merely to train skilled gardeners or farmers—although it might be mentioned in passing that many of the boys who have been taught school gardening have turned out to be amongst the most successful of the gardeners, farmers and allotment-holders, both at home and abroad, but rather to train pupils full of resource and initiative, with confidence in themselves and having an alert mentality well stocked with common sense.

It is urged that pupils taking up this subject have always something to do themselves, both with their hands, eyes, and brains; some definite problem to tackle, to observe and to await the result of. As a consequence they become intensely interested, and their powers of observation, thinking, and reasoning, soon show signs of development.

In attacking the varied and never-ending problems, in order to learn something of Nature and her ways, science and scientific methods are learned and brought to bear, and as much of the work is done by the pupils rather than by the teacher, they develop habits of self-reliance, etc., which often prove of great value in after life.—Journal, Dept. of Agric. (Ireland).

THE MUSHROOM.

AGARICUS COMPESTRIS.

H. E. HOUGHTON.

This favourite edible *Fungi* is grown by amateurs with much difficulty on the Plains and Hills and sometimes "mushrooming" is practised by Indians and Europeans who gather them in gardens and fields, and although they may be able to distinguish between the edible ones, and the poisonous toadstools, it is said that there is danger even in eating really good mushrooms as they develop poisonous properties if stale. Florence Stackpole, the lecturer to the National Health Society, writes that mushrooms are like fish in that "they deteriorate rapidly with keeping." People have sometimes become ill after eating mushrooms, and thought that the illness was caused by the mushrooms being poisonous, whereas in actual fact they were perfectly good, but were stale.

"Another thing with regard to mushrooms which cannot be too widely known is that they must never be eaten after re-heating. If cooked mushrooms are left over from a meal they should be burnt, or thrown away. They should never be served up a second time. You cannot eat re-cooked mushrooms with safety; therefore the risk of doing so should never be run."

When mushrooms, or edible toadstools are collected they should be placed on a flat dish and slightly sprinkled with fine salt to bring out quickly the small grubs, or insects that are usually to be found in them.

The toadstool, or mushroom consists of the cap known botanically as "*pileus*" and a stalk known as "*stipe*" in some cases the stock comes out from a bulb, or swollen base near the earth which is called "*volva*" the presence, or absence of this "*volva*" is of very great importance as the most poisonous are in that group; many toadstools also have a ring half way between the bulb, or "*volva*" and the cap, or "*pileus*."

It is by the underside of the cap called the "*hymenium*" that toadstools are classified and also determined as "*innocent*" or non-poisonous; those that have the underside of the cap "*smooth*" and also "*spiny*" and known as "Hedgehog" toadstools are all non-poisonous, but very few can be eaten on account of the leatheriness of their texture.

The whole subject is full of difficulty and advice can only be given by an expert to distinguish the poisonous from the non-poisonous. There are four classes of mushrooms the fourth class is, however, again divided into five sub-classes according to colour, being White, Black, Ochre, Brown, Rose or Red and curiously enough it is the White having the bulb or "*volva*" and ring half, to three-quarters up the stalk, or "*stipe*" which are the most poisonous.

In 1899 when engaged in contributing information for this Society's Quarterly Proceedings I came on the very small mushrooms in the Ornamental Gardens known in Tamil as *Noyce Kalan* of which the Indians are very fond, and which they collect and make into a delicious curry. I have also met with the Black and Brown varieties, and the White toadstools with the bulb, and ring.

The extract from Florence Stackpole's letter applies to conditions in England; it would be interesting to ascertain whether these conditions apply equally to cooked mushrooms grown on the plains of India where flesh and fish deteriorate so quickly.—Pro. Agri-Horti. Soc., Madras.

THE YIELD OF PAPER ON GREEN STEM OF BANANA.

CLAYTON BEADLE and HENRY P. STEVENS.

As a general rule, materials such as crop plants, when tested to determine their value for paper-making, are sent over in the form of dried stems, generally gathered on the field in the green state and dried before being sent off, or in some few cases in the form of "dressed" fibre prepared by combing the green stems or passing them through crushing rollers, and drying. All analytical figures in such cases have to be calculated upon the weight of the plant as received. All such figures, although valuable in themselves, lose most of their practical utility when applied to green crop plants such as the banana; in fact, green crop plants in general. Moreover, the mere fact that the banana stem is capable of being converted into paper, and is at the same time a waste and hitherto unutilised product, is of little practical importance unless it is taken in conjunction with the cost of gathering and transport of the green stems from the field to a centre or locality where it can be dealt with. On this point no opinion can be formed until some knowledge is obtained of the yield of paper or pulp on the *green* weight of the stem.

This particular point of view appears never to have been sufficiently considered when discussing the possibilities of certain classes of fibres, such as green crop plants, for the manufacture of paper. The class of fibre to which we refer is typified, for instance, by the banana, which has been so frequently experimented upon for the manufacture of paper on account of the enormous quantities of banana plants which go to waste. If a plant like the banana is to be used in the manufacture of paper, it must be either taken in the dried state and transported to some locality where the whole of the dried plant is converted into paper, or it must be transported in the green state to some centre where the same operation can be conducted. Or, if it is to be shipped, in addition to reaping and gathering, it would have to be passed through crushing rollers, dried, and baled. It is difficult to conceive how these operations could be carried out on the field, and, by whatever method the fibre is obtained, it is of great importance to form an estimate of the amount of green material which would have to be handled to produce a ton of paper. With a view to arriving at some conclusion in regard to this point, we have constructed the accompanying table, which gives in column 1 the percentage of fibre obtained on the green weight, column 2 the number of tons of green weight that would have to be handled to yield a ton of dressed fibre, column 3 the approximate number of tons of green weight which would have to be handled and transported per ton of paper produced. These results have been gathered together from different sources. The mean figure for the green weight to be handled is no less than 132 tons per ton of paper produced. This assumes a production of paper equal to half the dry weight of the raw fibre. This is a figure which for this class of paper we find to be a very reasonable assumption. It is quite evident that the mere reaping, gathering and transporting, even for a short distance, of such large weight of green stem would render the cost of getting together large supplies of these materials absolutely prohibitive.

If the material is merely dried upon the field and then transported in the dry state, without dressing or washing, the yield is very disappointing. In the case of a fibre of this description which, when passed through crushing rollers and dried, yielded between 50 and 60 per cent. of paper on the dry weight of the fibre, the same material when dried on the field, like making hay, and then treated chemically by conversion into paper, only yielded 32 per cent. The crushed and dried material consumed 6 per cent. of alkali on the weight of the paper produced, whereas the plant dried without washing,

by reason of the fact that it contained much material which had to be got rid of and which would otherwise have been removed by the crushing mills, consumed 18 per cent. of soda, also calculated on the weight of paper produced. It is quite evident, therefore, that fibre of this class would have to undergo some mechanical process of treatment on the field or at some convenient collecting centre, very near to the gathering ground, in order that the chemical treatment could be effected in an economical manner.

TABLE.—*Summarising Field Trials on Yield of Fibre on Green Stem and Approximate Amount of Green Stem required to produce One Ton of Paper.*

	Kew Bulletin, I Vegetable Fibres		Dressed fibre on green weight of plant,	Tons of green weight per ton of fibre.	Tons of green weight per ton of paper.
	Page.	Line.	o/o		
Musa textilis ...	97	6	1·49	67	134
	97	31	1·66	60	120
	98	15	1·44	70	140
Banana ...	98	22	1·02	98	196
	98	28	1·44	70	140
	98	39	1·81	55	110
Plantain ...	98	41	2·25	44	88
Musa ...	98	49	1·87	53	106
Musa ensete ...	99	10	1·16	86	172
Musa sapientum (var. *paradisiaca*)	103	46	1·44	70	140
Plantain ...	103	48	1·81	55	110
		Average ...		66·2	132·4

—CHEMICAL NEWS.

PAPAIN FROM MONTSERRAT.

The amount of papain exported in 1914 was 2,443 lb. valued at £1,269. Prices continue to remain steady, and a very considerable stimulus has been given to the planting of papaw trees, as the result of a recent visit of MR. J. H. CUMMINGS, of a firm of manufacturing chemists of Toronto, Canada, which firm is anxious to handle larger quantities of the article.

Several estate owners have become interested, and the extent of the area now being planted in papaws ought appreciably to affect the exports in the course of a year or two. Exports of papain touched £2,000 in value in the year 1903, but had dropped again to £483 in value in 1908.

Until recently there do not appear to have been any regular plantations of papaws, the bulk of the drug coming from isolated trees or clumps of trees cultivated by the peasants.—AGRIC. NEWS.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.)

	QUALITY.	Quotations.
ALOES, Soccotrine cwt.	Fair to fine	100/ a 110/
Zanzibar & Hepatic ,,	Common to good	40/ a 75/
ARROWROOT (Natal) lb.	Fair to fine	3½d a 4d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 5/ a £7 10/
East Indian, bleached ,,	Fair to good	£8 12/6 a £8 15/
unbleached ,,	Dark to good genuine	£6 a £6 10/
Madagascar ,,	Dark to good palish	£6 15/ a £7 10/
CAMPHOR, Japan lb.	Refined	1/7½ a 1/10½
China cwt.	Fair average quality	155/ nom.
CARDAMOMS, Tuticorin	Good to fine bold	3/6 a 4/6
per lb.	Middling lean	2/ a 2/9
Malabar, Tellicherry ,,	Good to fine bold	3/6 a 4/6
Calicut ,,	Brownish	2/ a 3/
Mangalore ,,	Med Brown to good bold	3/ a 5/10
Ceylon, Mysore ,,	Small fair to fine plump	1/8 a 5/6
Malabar ,,	Fair to good	1/7 a 1/8
Seeds, E. I. & Ceylon ,,	Fair to good	1/7 a 1/9
Ceylon "Long Wild" ,,	Shelly to good	1/ a 1/6 nom.
CASTOR OIL, Calcutta ,,	Good 2nds	3½d
CHILLIES, Zanzibar cwt.	Dull to fine bright	110/ a 120/
Japan ,,	Fair bright small	110/a 120/
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1⅜d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅝d a 4d
CINNAMON, Ceylon 1sts.	Fair to fine quill	1/1 a 1/9
per lb. 2nds.	,, ,,	1 a 1/6
3rds.	,, ,,	11d a 1/4
4ths.	,, ,,	10d a 1/1
Chips.	Fair to fine bold	2¾d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1/2
Amboyna ,,	Dull to fine	10½d a 11d
Zanzibar ,,	Fair and fine bright	6½d a 7d
Madagascar ,,	Fair	8d
Stems ,,	Fair	1⅞d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	
COCOA, Ceylon Plant. ,,	Special Marks	87/ a 92/6
	Red to good	80/ a 86/
Native Estate ,,	Ordinary to red	57/ a 87/
Java and Celebes ,,	Small to good red	70/6 a 98/
COLOMBO ROOT ,,	Middling to good	32/6 a 40/
CROTON SEEDS, sifted,,	Dull to fair	42/6 a 47/6
CUBEBS ,, ,,	Ord. stalky to good	160/ a 180/
GINGER, Bengal, rough ,,	Fair	35/
Calicut, Cut A ,,	Medium to fine bold	75/ a 85/
B & C ,,	Small and medium	50/ a 70/
Cochin, Rough ,,	Common to fine bold	40/ a 47/6
	Small and D's	40/
Japan ,,	Unsplit	40/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	60/s a 85s
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 10/ a £7 5/
Madagascar ,,	Fair to good palish	£4 a £8
,,	,, ,, red	£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	45/ a 55/ nom.
Turkey sorts ,,	... ...	67/6 a 72/6
Ghatti ,,	Sorts to fine pale	17/ a 27/
Kurrachee ,,	Reddish to good pale	22/6 a 32/6 nom.
Madras ,,	Dark to fine pale	20/ a 30/ nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£15 a £20
	com. stony to good block	£4 a £10
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	60/ a 70/
Somali ,,	,, ,,	50s a 60s
OLIBANUM, drop ,,	Good to fine white	50s a 55s
,,	Middling to fair	40s a 45s
pickings ,,	Low to good pale	20 a 35/
siftings ,,	Slightly foul to fine	25s a 35s
INDIA RUBBER lb.	Fine Para smoked sheets	2/6
Ceylon, Straits, ,,	Crepe ordinary to fine	2/6¾
Malay Straits, etc. ,,	Scrap fair to fine	2/2
Assam ,,	Fair 11 to ord. red No. 1.	1/10
Rangoon ,,	,, ,, ,,	1/11

	QUALITY.	Quotations.
INDIA RUBBER lb.		
Borneo ,,	Common to good	1/11
Java ,,	Good to fine red	2/
Penang ,,	Low white to prime red	1/9 a 1/10
Mozambique ,,	Fair to fine red ball	2/4
,,	Sausage, fair to good	2/4
Nyassaland ,,	Fair to fine ball	2/3
Madagascar ,,	Fr. to fine pinky & white	1/10
,,	Majunga & blk coated	1/7
,,	Niggers, low to good	1/ a 1/5
New Guinea ,,	Ordinary to fine ball	2/ a 2/3
INDIGO, E.I. Bengal ,,	Shipping mid to gd. violet	14/6 a 15/6
,,	Consuming mid. to gd.	13/9 a 14/6
	Ordinary to middling	12/6 a 13/6
,,	Mid. to good Kurpah	8/9 a 11/
,,	Low to ordinary	6/6 a 8/6
,,	Mid. to fine Madras	4/6 a 5/6
MACE, Bombay & Penang	Pale reddish to fine	2/2
per lb.	Ordinary to fair	2/ a 2/1
Java	,, ,, good pale	2/ a 2/2
Bombay	Wild	5d
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	1/9 a 2/
	80's	1/5
	110's	1/
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20
NUX VOMICA, Cochin	Ordinary to good	25/ a 27/
per cwt. Bengal	,, ,,	23/ a 24/
Madras	,, ,,	23/ a 25/
OIL OF ANISEED lb.	Fair merchantable	3/5½
CASSIA ,,	According to analysis	4/ a 4/3
LEMONGRASS oz.	Good flavour & colour	1⅛d
NUTMEG ,,	Dingy to white	1⅛d a 1⅜d
CINNAMON ,,	Ordinary to fair sweet	5½d a 1s 6d
CITRONELLE lb.	Bright & good flavour	2/
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	8½d
Ceylon ,, ,,	Fair to fine bold heavy	8⅝d
Singapore ...	Fair	7¾d
Acheen & W. C. Penang	Dull to fine	nom.
(White) Singapore ,,	Fair to fine	9⅜d
Siam ,,	Fair	9¼d
Penang ,,	Fair	9¼d
Muntok ,,	Fair	10⅜d
RHUBARB, Shenzi ,,	Ordinary to good	2/3 a 3/6
Canton ,,	Ordinary to good	1/6 a 2/6
High Dried,,	Fair to fine flat	1/3 a 1/4
	Dark to fair round	8d a 8½d
SAGO, PEARL, large--cwt	Fair to fine	24/6 a 25/
medium ...	,, ,,	24/6 a 25/
small ...	,, ,,	22/ a 23/
Flour ...	Good pinky to white	18/ a 19/
SEEDLAC cwt.	Ordinary to gd. soluble	55/ a 90/
SENNA, Tinnevelly lb.	Good to fine bold green	1/ a 1/1
	Fair greenish	9½d a 10⅗d
	Common specky & small	8¼d a 8⅔d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	50/ a £5 10/
Bombay ,,	,, ,,	60/ a £5 10/
Mergui ,,	Chicken to bold	£6 10/ a £12
Manilla ,,	,, ,,	£6 10/ a £10/
Banda ,,	Sorts	30/
Green Snail,,	Small to large	55/ a 75/
Japan Ear ,,	Trimmed selected small to bold	47/ a £5 15
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	25/ a 26/
per cwt. Madras	Inferior to good	Nominal.
TORTOISESHELL—		
Zanzibar & Bombay lb.	Small to bold	10/ a 25/
	Pickings	5/ a 15/
TURMERIC, Bengal cwt.	Fair	37/6
Madras ,,	Finger fair to fine bold	40/ a 42/6
Do. ,,	Bulbs ,, ,, bright	23/
Cochin ,,	Finger fair	35/ nom.
	Bulbs ,,	25/
VANILLOES— lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½ in.	7/ a 12/
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	6/6 a 7/6
Seychelles ... 3rds.	Lean and inferior	5/6 a 6
VERMILLION ... lbs.	Fine, pure, bright	2/7
WAX, Japan, squares, cwt.	Good white hard	70/

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THE SPILL (600 FEET LONG) OF
KALAWEWE TANK RESTORED IN 1887.

"*Kalawewe,* in the North-Central Province, was formed by King Dhatu Sen about the year 460 by driving an embankment across the Kalaoya which flows from the vicinity of the great temple at Dambulla and reaches the sea at Kalpitiya.....The area submerged was more than 40 miles in circumference and the waters were thrown back by the embankment till it overflowed the lowlands round the rock which overhangs the temple at Dambulla at a distance of 20 miles from Kalawewe. In the opposite direction a canal more than 60 miles in length communicated with Anuradhapura. The retaining bund was more than 12 miles long, and the spill was formed of hammered granite."—*Sir Emerson Tennant.*